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CLAIMS

[Claim(s)]

[Claim 1] The means for switching which are the circuits which carry out the electric discharge maintenance drive of the scanning electrode of a plasma display in parallel, and combine scanning voltage and an electric discharge sustaining voltage with the aforementioned scanning electrode alternatively, An inductor means by which the 2nd terminal is connected to all scanning electrodes through the aforementioned means for switching, A source means of driver voltage to supply driver voltage, and a voltage supply means to supply the electric discharge sustaining voltage which shows a bigger voltage value than the aforementioned driver voltage, The 2nd switching means which combine alternatively the 2nd terminal of the aforementioned inductor means, and the aforementioned voltage supply means, The 1st switching means which combine alternatively the 1st terminal of the aforementioned inductor means, and the aforementioned source means of driver voltage according to change of an input signal, In the situation chosen so that the switch control means which answer the size of the current which flows for the aforementioned inductor means may be provided and the aforementioned means for switching may combine an electric discharge sustaining voltage with the aforementioned scanning electrode Between charge states, the 1st switching means of the above will combine the aforementioned source means of driver voltage with the 1st terminal of the aforementioned inductor means, if an input signal carries out 1st change. The 1st current which charges the capacity of the aforementioned scanning electrode through the aforementioned inductor means arises. It causes that the aforementioned inductor means reaches the voltage on which the aforementioned scanning electrode exceeds the aforementioned driver voltage, and the 1st current of the above decreases toward zero soon. the aforementioned switch control means The size of the current which changes the 2nd switching means of the above into an open state until very recently, and flows for the aforementioned inductor means from which the 1st current of the above returns to zero at least is answered. It makes flow from before and begins. the above a few with which the flow of the 1st current of the above reaches zero in the 2nd switching means -- Make it switch-on completely [when reaching zero], and the 2nd switching means of the above are closed. Between the electric discharge maintenance states following it and the aforementioned voltage supply means are a plasma display drive circuit characterized by supplying both flyback current to the discharge current and the aforementioned inductor means to the aforementioned scanning electrode.

[Claim 2] The 3rd switching means which combine alternatively the 1st terminal and source means of driver voltage of an inductor means according to change of the 2nd of an input signal, The 4th switching means which combine alternatively the 2nd terminal and source of common potential of the aforementioned inductor means are provided further. the 3rd switching means of the above If an input signal carries out 2nd change, the aforementioned source means of driver voltage will be combined with the 1st terminal of the aforementioned inductor means. The 2nd discharging current produces the capacity of a scanning electrode through the aforementioned inductor means. It causes that the aforementioned inductor means reaches the voltage on which the aforementioned scanning electrode is less than the aforementioned driver voltage, and the 2nd current of the above decreases toward zero soon. the aforementioned switch control means The size of the current which changes the 4th switching means of the above into an open state until very recently, and flows for the aforementioned inductor means from which the 2nd current of the above returns to zero at least is answered. It makes flow from before and begins. the above a few with which the flow of the 2nd current of the above reaches zero in the 4th switching means -- It is made switch-on completely [when reaching zero], and the 4th switching means of the above are closed. the aforementioned source of common potential The plasma display drive circuit according to claim 1 characterized by the electric discharge way and the bird clapper to the aforementioned panel capacity while flowing the flyback current from the aforementioned inductor means.

[Claim 3] The plasma display drive circuit according to claim 1 characterized by means for switching containing the diode with which the anode plate was combined with the 2nd terminal of an inductor means, and cathode was combined with the scanning electrode in the 2nd terminal and each scanning electrode of an inductor means, respectively.

[Claim 4] The plasma display drive circuit according to claim 2 characterized by means for switching containing the diode with which the anode plate was combined with the scanning electrode and cathode was combined with the 2nd terminal of an inductor means in each scanning electrode and the 2nd terminal of an inductor means, respectively.

[Claim 5] The plasma display drive circuit according to claim 3 characterized by means for switching containing the switching means by which parallel connection was carried out to diode.

[Claim 6] The plasma display drive circuit according to claim 4 characterized by means for switching containing the switching means by which parallel connection was carried out to diode.

[Claim 7] The data electrode driving means which drive the data electrode of a plasma display in parallel alternatively and

which are circuits, combine each of the aforementioned data electrode with the 2nd terminal of an inductor means alternatively, and drive a data electrode, A source means of driver voltage to supply driver voltage, and a voltage supply means to supply the data voltage which shows a bigger voltage value than the aforementioned driver voltage, The 1st switching means which combine alternatively the 1st terminal of the aforementioned inductor means, and the aforementioned source means of driver voltage according to change of an input signal, The switch control means which answer the size of the current which flows for the aforementioned inductor means are provided. the aforementioned data electrode driving means The 5th switching means which combine alternatively the aforementioned data electrode which should be made to discharge, and the 2nd terminal of the aforementioned inductor means, It has the 2nd switching means which make it flow through the aforementioned data electrode and the aforementioned voltage supply means which are combined with the 2nd terminal of the aforementioned inductor means by the 5th switching means of the above alternatively. The 1st switching means of the above will combine the aforementioned source means of driver voltage with the 1st terminal of the aforementioned inductor means, if an input signal carries out 3rd change. The 1st current which charges the capacity of the aforementioned data electrode combined through the aforementioned inductor means by the 5th switching means of the above arises. It causes that the aforementioned inductor means reaches the voltage on which the aforementioned data electrode exceeds the aforementioned driver voltage, and the 1st current of the above decreases toward zero soon. the aforementioned switch control means The size of the current which changes the 2nd switching means of the above into an open state until very recently, and flows for the aforementioned inductor means from which the 1st current of the above returns to zero at least is answered. It makes flow slowly from before and begins. the above a few with which the flow of the 1st current of the above reaches zero in the 2nd switching means -- It is made switch-on completely [when reaching zero], and the 2nd switching means of the above are closed. the aforementioned voltage supply means The plasma display drive circuit characterized by supplying both flyback current to the discharge current and the aforementioned inductor means to the aforementioned data electrode between the voltage maintenance states following it.

[Claim 8] The 2nd switching means are plasma display drive circuits according to claim 7 characterized by connecting an end to a voltage supply means, connecting the other end to the 2nd terminal of an inductor means, and supplying the discharge current to a data electrode via the 5th switching means between voltage maintenance states.

[Claim 9] The plasma display drive circuit according to claim 8 characterized by preparing the 2nd one switching means common to each data electrode.

[Claim 10] The 2nd switching means are plasma display drive circuits according to claim 7 characterized by connecting an end to a voltage supply means, connecting the other end to a data electrode, and supplying the flyback current to the aforementioned inductor means via the 5th switching means between voltage maintenance states.

[Claim 11] The 3rd switching means which combine alternatively the 1st terminal and source means of driver voltage of an inductor means according to change of the 4th of an input signal, The 4th switching means which make it flow through the aforementioned data electrode which is combined with the 2nd terminal of an inductor means by the 5th switching means in the aforementioned data electrode driving means, and the source of common potential alternatively are provided further. The 3rd switching means of the above will combine the aforementioned source means of driver voltage with the 1st terminal of the aforementioned inductor means, if an input signal carries out 4th change. The 2nd discharging current produces the capacity of a scanning electrode through the aforementioned inductor means. It causes that the aforementioned inductor means reaches the voltage on which the aforementioned scanning electrode is less than the aforementioned driver voltage, and the 2nd current of the above decreases toward zero soon. the aforementioned switch control means The size of the current which changes the 4th switching means of the above into an open state until very recently, and flows for the aforementioned inductor means from which the 2nd current of the above returns to zero at least is answered. It makes flow from before and begins. the above a few with which the flow of the 2nd current of the above reaches zero in the 4th switching means -- It is made switch-on completely [when reaching zero], and the 4th switching means of the above are closed. the aforementioned source of common potential The plasma display drive circuit according to claim 7 characterized by the electric discharge way and the bird clapper to the aforementioned data electrode capacitance while flowing the flyback current from the aforementioned inductor means.

[Claim 12] The 4th switching means are plasma display drive circuits according to claim 11 which an end is connected to the source of common potential, and the other end is connected to the 2nd terminal of an inductor means, and are characterized by the electric discharge way and the bird clapper to data electrode capacitance via the 5th switching means.

[Claim 13] The plasma display drive circuit according to claim 12 characterized by preparing the 2nd one switching means common to each data electrode.

[Claim 14] The 2nd switching means are plasma display drive circuits according to claim 11 characterized by connecting an end to the source of common potential, connecting the other end to a data electrode, and flowing the flyback current from the aforementioned inductor means via the 5th switching means.

[Claim 15] The plasma display drive circuit according to claim 7 to 14 characterized by connecting a ballast capacitor between the 2nd terminal of an inductor means, and the source of common potential.

[Claim 16] The plasma display drive circuit according to claim 1 to 14 characterized by the voltage of the source means of driver voltage being about 1 of voltage of voltage supply means/2.

[Claim 17] The plasma display drive circuit according to claim 1 to 14 characterized by carrying out inductive coupling of the switch control means to the inductor means.

[Claim 18] The plasma display drive circuit according to claim 1 or 7 where only a period after switch control means show

the voltage value to which a scanning electrode exceeds driver voltage until the 1st current reaches zero is characterized by having the 1st sense circuit which makes the 2nd switching means closed.
[Claim 19] The plasma display drive circuit according to claim 1 or 7 characterized by providing further a flyback return circuit including a waste means of resistance for it to be combined between the 1st terminal of an inductor means, and a voltage supply means, and to extinguish flyback current.
[Claim 20] The plasma display drive circuit according to claim 2 or 11 where only a period after switch control means show a voltage value with a scanning electrode lower than driver voltage until the 2nd current reaches zero is characterized by having the 2nd sense circuit which makes the 4th switching means closed.
[Claim 21] The plasma display drive circuit according to claim 2 or 11 characterized by providing further a flyback return circuit including a waste means of resistance for it to be combined between the 1st terminal of an inductor means, and a common voltage source, and to extinguish flyback current.
[Claim 22] The plasma display drive circuit according to claim 7 to 21 characterized by replacing with a data electrode, replacing with a scanning electrode and data voltage, and considering as scanning voltage.
[Claim 23] The plasma display drive circuit according to claim 22 characterized by replacing with scanning voltage and considering as an electric discharge sustaining voltage.
[Claim 24] An anode plate the 2nd terminal and each scanning electrode of an inductor means, respectively The 2nd terminal of an inductor means, [means for switching] An anode plate each scanning electrode and the 2nd terminal of an inductor means in the diode with which cathode was combined with the scanning electrode, and a row, respectively A scanning electrode, In the plasma display drive circuit containing the diode with which cathode was combined with the 2nd terminal of an inductor means, and the switching means by which parallel connection was further carried out to each diode according to claim 3 Furthermore, the plasma display drive circuit characterized by having the leak switching means which leak the predetermined voltage concerning the switching means by which parallel connection was carried out to diode.
[Claim 25] either of the claims 1-24 -- the plasma display equipment which carries out [providing the plasma display equipped with the plasma display drive circuit of a publication, two or more scanning electrodes which were formed in the coplanar, and which are mutually concurrent and the electric-discharge maintenance electrode formed in parallel to the aforementioned scanning electrode, and two or more data electrodes that are insulated with an electric-discharge maintenance electrode by the aforementioned scanning electrode row, intersect perpendicularly with it, and are mutually concurrent at least, and] as the feature
[Claim 26] The TV apparatus characterized by having plasma display equipment and a broadcast receiving set according to claim 25.
[Claim 27] The computer apparatus characterized by having plasma display equipment, alter operation equipment, and a processing unit according to claim 25.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] It is related with the various equipments using the thing about the circuit which prevents that the flyback current which this invention enabled a plasma display drive circuit and correctly controllable especially charge recovery, and was generated in guidance does influence disadvantageously for the pixel position of a panel, and the circuit concerned.
[0002]
[Description of the Prior Art] As the 1st conventional technology, there is a publication-number No. 265397 [five to] official report. Since a charge was mutually collected and reused also about the charge and discharge to the scanning electrodes Y1-Yn using the common capacitor, the 1st, and 2nd coils to the independent scanning electrodes Y1-Yn according to the conventional technology of **** 1, it was what does so the effect that charge recovery is attained with easy composition.
[0003] Moreover, there is a publication-number No. 249916 [five to] official report as the 2nd conventional technology. in the circuit which drives a capacitive load with low power, since the Prior art of **** 2 had connected the invalid charge recovery circuit which used the inductor for one power terminal, it was what does so the effect that the recovery which is the charge which exists in a scanning electrode and a data electrode is attained Moreover, there is a publication-number No. 160901 [eight to] official report as the 3rd conventional technology. Two or more scanning electrodes which formed the Prior art of **** 3 in the coplanar and which are mutually parallel, In the drive circuit of the display panel which impresses a data pulse to the data electrode of the display panel equipped with two or more data electrodes which are insulated with the scanning electrode concerned, intersect perpendicularly with the scanning electrode concerned, and are mutually parallel at least Have the capacitor and auxiliary capacitor of the aforementioned charge recovery, and between the end of the capacitor for the aforementioned charge recovery, and the data voltage input terminal which supplies data voltage to IC which drives the aforementioned data electrode When the switching means which make the current of the sense which collects charges energize are prepared, an auxiliary capacitor is connected between a data voltage input terminal and grounding and the other end of the capacitor for charge recovery has the charge recovery circuit of the data pulse grounded It was what can respond also to the display panel of which high-speed operation is required like a plasma panel.
[0004] Furthermore, there is a publication-number No. 160219 [seven to] official report as the 4th conventional technology. In the driving gear of AC type flat-surface display constituted by the electrode group by which the Prior art of **** 4 has been arranged in the shape of a matrix While preparing the push pull type driver circuit constituted from two transistors by each of two power supply line pairs linked to the driver circuit which drives two or more display electrodes scanned By establishing the leak control switch means to which the predetermined charge which connected with each driver circuit and was impressed to the power circuit means and power supply line which impress predetermined voltage to a power supply line is made to leak, pressure-proofing was low, high-speed sequential scanning was possible, and it was what can perform charge recovery.
[0005]
[Problem(s) to be Solved by the Invention] However, the "flyback" changes by the side of charge recovery of the inductor used in order to carry out the trigger of the flow of an output driver are made generated in the circuit shown in such the conventional 1st mentioned above - the 4th technology. Moreover, the flyback current for controlling a maintenance driver makes the side effect that current is pulled out from a panel generated, while an output driver is flowing. Ringing current is generated for this side effect. That is, a voltage flyback will occur in the recovery side of an inductor in the end of a resonance cycle. Inductor voltage is the compulsive voltage and the retrose which were impressed first. It flows in order to make flyback current in agreement with panel voltage and to charge or discharge the capacity by the side of recovery of an inductor. The increase in the unrecoverable charge which a charge is transmitted in the direction contrary to working [the] and the changes demanded, consequently is wasted by the circuit, and the technical problem that a noise occurred when an output driver flows occurred.
[0006] this invention solves the above-mentioned technical problem, detects the current which flows a coil for the reason, has the composition of having the switch control means which control switching means by the value of the current, and carries out the following operation. These switch control means have a secondary winding, and the secondary winding concerned produces the voltage which is proportional to voltage at the moment of starting a coil. If current flows into panel capacity through a coil, when panel voltage becomes equal to driver voltage, the voltage concerning a coil will decrease to zero. In order that the energy accumulated at the coil may charge panel capacity further, it is made for current to continue flowing. If

panel voltage exceeds driver voltage and it goes up, it will reverse and the polarity of the voltage of a coil will increase with panel voltage. It is used for this polar change and a power surge being taken over to a secondary coil, and making it flow through each output driver. The flow of an output driver is restricted by gate resistance. This restricts the current on which the capacity of MOSFET flows through the MOSFET, transmitting the energy to which the coil has stopped at it to a panel. Since a polar change will surely be produced before it can flow through an output driver, as for the total amount of the energy transmitted with the coil, even the basis of a change capacitive load is always maximized. Since the output driver flowed slowly, and it has fully flowed when a flyback happens, the EMI effect is decreased. This removes the ringing current which appears in a Prior art.

[0007] Correctly controllable charge recovery is enabled by this, and the flyback current generated in guidance aims at preventing doing influence disadvantageously for the pixel position of a panel.

[0008]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem the technical means of this invention The means for switching which combine scanning voltage and an electric discharge sustaining voltage with a scanning electrode alternatively, An inductor means by which the 2nd terminal is connected to all scanning electrodes through means for switching, A source means of driver voltage to supply driver voltage, and a voltage supply means to supply the electric discharge sustaining voltage which shows a bigger voltage value than driver voltage, The 2nd switching means which combine alternatively the 2nd terminal and voltage supply means of an inductor means, The 1st switching means which combine alternatively the 1st terminal and source means of driver voltage of an inductor means according to change of an input signal, In the situation chosen so that the switch control means which answer the size of the current which flows for an inductor means may be provided and means for switching may combine an electric discharge sustaining voltage with the aforementioned scanning electrode Between charge states, the 1st switching means will combine the source means of driver voltage with the 1st terminal of an inductor means, if an input signal carries out 1st change. The 1st current which charges the capacity of a scanning electrode through an inductor means arises. It causes that an inductor means reaches the voltage on which a scanning electrode exceeds driver voltage, and the 1st current decreases toward zero soon. switch control means The size of the current which changes the 2nd switching means into an open state until very recently, and flows for an inductor means from which the 1st current returns to zero at least is answered. It makes flow slowly from before and begins. the above a few with which the flow of the 1st current reaches zero in the 2nd switching means -- When reaching zero, it is completely made switch-on and the 2nd switching means are closed, and a voltage supply means supplies both flyback current to the discharge current and the inductor means to a scanning electrode between the electric discharge maintenance states following it.

[0009] Moreover, the 3rd switching means with which this invention combines alternatively the 1st terminal and source means of driver voltage of an inductor means according to change of the 2nd of an input signal, The 4th switching means which combine alternatively the 2nd terminal and source of common potential of an inductor means are provided further. the 3rd switching means If an input signal carries out 2nd change, the source means of driver voltage will be combined with the 1st terminal of an inductor means. The 2nd discharging current produces the capacity of a scanning electrode through an inductor means. It causes that an inductor means reaches the voltage on which a scanning electrode is less than driver voltage, and the 2nd current decreases toward zero soon. switch control means The size of the current which changes the 4th switching means into an open state until very recently, and flows for an inductor means from which the 2nd current returns to zero at least is answered. It makes flow slowly from before and begins. the above a few with which the flow of the 2nd current reaches zero in the 4th switching means -- When reaching zero, it is completely made switch-on and the 4th switching means are closed, and the source of common potential serves as an electric discharge way to panel capacity while flowing the flyback current from an inductor means.

[0010] Moreover, the data electrode driving means which this invention combines each of a data electrode with the 2nd terminal of an inductor means alternatively, and drive a data electrode, A source means of driver voltage to supply driver voltage, and a voltage supply means to supply the data voltage which shows a bigger voltage value than driver voltage, The 1st switching means which combine alternatively the 1st terminal and source means of driver voltage of an inductor means according to change of the 3rd of an input signal, The switch control means which answer the size of the current which flows for an inductor means are provided. data electrode driving means The 5th switching means which combine alternatively the data electrode which should be made to discharge, and the 2nd terminal of an inductor means, It has the 2nd switching means which make it flow through the data electrode combined with the 2nd terminal of an inductor means by the 5th switching means, and a voltage supply means alternatively. the 1st switching means If an input signal changes, the source means of driver voltage will be combined with the 1st terminal of the aforementioned inductor means. The 1st current which charges the capacity of the data electrode combined by the 5th switching means through the inductor means arises. It causes that an inductor means reaches the voltage on which a data electrode exceeds driver voltage, and the 1st current decreases toward zero soon. switch control means The size of the current which changes the 2nd switching means into an open state until very recently, and flows for an inductor means from which the 1st current returns to zero at least is answered. It makes flow slowly from before and begins. the above a few with which the flow of the 1st current reaches zero in the 2nd switching means -- When reaching zero, it is completely made switch-on and the 2nd switching means are closed, and a voltage supply means supplies both flyback current to the discharge current and the aforementioned inductor means to a data electrode between the voltage maintenance states following it.

[0011] Furthermore, the 3rd switching means which combine alternatively the 1st terminal and source means of driver voltage

of an inductor means according to change of the 4th of an input signal, The 4th switching means which make it flow through the aforementioned data electrode which is combined with the 2nd terminal of an inductor means by the 5th switching means in data electrode driving means, and the source of common potential alternatively are provided further. The 3rd switching means will combine the source means of driver voltage with the 1st terminal of an inductor means, if an input signal carries out 4th change. The 2nd discharging current produces the capacity of a scanning electrode through an inductor means. It causes that an inductor means reaches the voltage on which a scanning electrode is less than driver voltage, and the 2nd current decreases toward zero soon. switch control means The size of the current which changes the 4th switching means into an open state until very recently, and flows for an inductor means from which the 2nd current returns to zero at least is answered. It makes flow slowly from before and begins. the above a few with which the flow of the 2nd current reaches zero in the 4th switching means -- When reaching zero, it is completely made switch-on and the 4th switching means are closed, and the source of common potential serves as an electric discharge way to data electrode capacitance while flowing the flyback current from the aforementioned inductor means.

[0012]

[Embodiments of the Invention] In order to solve the above-mentioned technical problem, this invention detects the current which flows a coil in a plasma display drive circuit. It is a thing about the plasma display equipment possessing the thing which added the switch control means which control switching means by the value of the current, and the plasma display drive circuit concerned, the TV apparatus using the equipment, and a computer apparatus. By carrying out control which makes the switching means concerned switch-on completely [when the current which flows a coil by the aforementioned switch control means begins to make it flow through the switching means which reach zero, and which correspond from before for a while slowly and reaches zero] Since it has fully flowed when a flyback happens, the EMI effect can be decreased.

[0013] it can prevent that the flyback current which enabled correctly controllable charge recovery by this, and was generated in guidance does influence disadvantageously for the pixel position of a panel -- it is

[0014]

[Example] Hereafter, the example of this invention is explained based on an accompanying drawing.

(Example 1) Drawing 1 shows the important section circuitry of the X driver 11 of an example 1, and the Y driver 12. The X driver 11 is equipped with the capacitor 111 for recovery for charge recovery / reuse, the bidirectional switch 112, a coil 113, the switching means 114 for a maintenance pulse auxiliary output, the switching means 115 for a whole surface write-pulse output, and the switch control means 116 to the maintenance electrode X. The switch control means 116 detect the time of the current which flows a coil 113 becoming zero, and carry out control which becomes zero and which changes switching means 114A and 114B a little in this side. Moreover, there are two switching means 112A and 112B among the bidirectional switching means 112, and they have composition by which parallel connection was carried out. Moreover, there are two switching means 114A and 114B also in the switching means 114 for a maintenance pulse auxiliary output.

[0015] The end is connected to a grand line and, as for the capacitor 111 for recovery, the other end is connected to the maintenance electrode X through the bidirectional switching means 112 and the coil 113. Moreover, it connects with the sustaining-voltage supply line Vs through switching-means 114A, and connects with a grand line through switching-means 114B, and the maintenance electrode X is written in through switching means 115, and is connected to the voltage supply line Vw.

[0016] The example of concrete composition of the bidirectional switching means 112 and switching means 114 is explained to JP,5-265397,A. The Y driver 12 is equipped with the switch control means 126A and 126B which are combined with the semiconductor integrated circuit 121 for an indicative-data write pulse and maintenance pulse outputs, and the exterior of a semiconductor integrated circuit 121 by the capacitor 122 for recovery for power recovery / reuse, switching-means 123A, switching-means 123B, Coils 124A and 124B, switching-means 125A, switching-means 125B, and Coils 124A and 124B, and answer the flow of current to the scanning electrodes Y1-Yn.

[0017] The end is connected to a grand line, on the other hand, the other end is connected to the sustaining-voltage supply line Vs through switching-means 123A, coil 124A, and switching-means 125A, and, on the other hand, the capacitor 122 for recovery is connected to the grand line through switching-means 123B, coil 124B, and switching-means 125B. The current which charges the panel capacity of a scanning electrode through coil 124A produces switching-means 123A during combination, it causes that coil 124A reaches the voltage on which a panel terminal exceeds driver voltage, and current amounts to 0 on the point.

[0018] Moreover, switch control-means 126A operates so that switching-means 125A may be in an open state to the scanning electrodes Y1-Yn between charge states about a charge, the signal drawn from coil 124A is answered after that, and in order to which the flow of the current of coil 124A amounts switching-means 125A to 0] to cheat to switch-on completely out of a few in a front hit, it operates so that switching-means 125A may be closed slowly. The sustaining-voltage supply line Vs supplies both the current to a panel terminal, and the flyback current to coil 124A between the following states. Furthermore, it operates so that, as for switch control-means 126B, switching-means 125B may be in an open state between the electric discharge maintenance states of the charge of the scanning electrodes Y1-Yn, the signal drawn from coil 124B is answered after that, and in order [to which the flow of the current of coil 124B amounts switching-means 125B to 0] to cheat to switch-on completely out of a few in a front hit, it operates so that switching-means 125B may be closed slowly.

[0019] By connecting the node of coil 124A and switching-means 125A common to switching-means 1261A-126nA, the node of coil 124B and switching-means 125B is connected to switching-means 1261B-126nB, and it connects with the scanning electrode Yi, and connects with the connection of switching-means 34iA and switching-means 34iB. In addition,

switching-means 1261A-126nA and 1261B-126nB function on a scanning electrode as means for switching which combine scanning voltage and an electric discharge sustaining voltage alternatively.
[0020] In addition, the capacitors 111 and 122 for recovery are both 10 micro F which is 100 or more times of CP more fairly than the full capacity CP between the maintenance electrode X and the scanning electrodes Y1-Yn greatly, and it is made for there to be almost no voltage variation in the case of charge recovery / reuse. In the following explanation, both the voltage between terminals of the capacitors 111 and 122 for recovery is Vs/2.
[0021] Next, the case where the voltage waveform which shows an example of operation of the constituted this example to drawing 2 is impressed to the maintenance electrode X and the scanning electrodes Y1-Yn is explained like the above.
W) Both the switching means [and] 112A, 112B, 114A, 114B, 115, 123A, 123B, 125A, and 125B, 1261A-126nA [and], and 1261B-126nB both presuppose at the complete write-in period beginning that OFF, the maintenance electrode X, and the scanning electrodes Y1-Yn are a sustaining voltage Vs.
[0022] (1) If switching-means 123B and 1261A-126nB are turned ON in this state, charges will be collected from the scanning electrodes Y1-Yn through coil 124B and switching-means 123B by the capacitor 122 for recovery. By inductance operation of coil 124B, even if the voltage of the scanning electrodes Y1-Yn is set to Vs/2, current continues flowing, and the voltage of the scanning electrodes Y1-Yn goes to GND level. However, the voltage of the scanning electrodes Y1-Yn has not fallen to GND level by the power consumption of the resistance component of this current path. Then, the current on which switch control-means 126B flows coil 124B at this time detects a bird clapper to 0, it flows through switching-means 125B slowly, and the charge which is set to 0 and in which the scanning electrodes Y1-Yn remained is made to discharge to a grand line side through switching-means 125B in this side for a while. At this time, it is completed as 0 by the voltage between terminals of switching-means 123B and coil 124B. And when it is thought that the scanning electrode Y1 was set to GND level, both switching-means 123B and switching-means 125B are turned OFF. In addition, it may not be simultaneous when turning OFF switching-means 123B and switching-means 125B.
[0023] After turning ON switching means 115, writing in the voltage of the maintenance electrode X at the time of control of (2) and (1) and making it go up to voltage Vw at it, switching means 115 are turned OFF. By this, the maintenance electrode X writes in from the maintenance electrode Vs, and it starts suddenly to voltage Vw, and writes in between the maintenance electrode X and the scanning electrodes Y1-Yn, and electric discharge arises.
(3) Next, turn ON simultaneously switching-means 112B and switching-means 123A. Thereby, the charges on the maintenance electrode X are collected through a coil 113 and switching-means 112B by the capacitor 111 for recovery, and the recovery charge of the capacitor 122 for recovery is simultaneously charged by the scanning electrodes Y1-Yn through switching-means 123A, coil 124A, and diode 1261B-126nB.
[0024] And switching-means 123B is closed. Moreover, the EMI effect can be decreased when the current which flows coil 124A detects a bird clapper to 0, switch control-means 126A operates so that switching-means 125A may be closed by around the time of the flow of current amounting to 0, and flyback current occurs. Moreover, turn ON switching-means 114B and the charge which remained on the maintenance electrode X which cannot be collected by the power consumption of the resistance component of a current path is made to discharge to a grand line side, and switching-means 125A is turned ON and, simultaneously with this, it is completed as 0 (the potential of each terminal is Vs) by the voltage between terminals of coil 124A (before maintenance electric discharge generating). When it is thought that the maintenance electrode X was set to GND level, and the scanning electrodes Y1-Yn became a sustaining voltage Vs, both switching-means 112B, switching-means 114B, switching-means 123A, and switching-means 125A are turned OFF. in addition, it may not be simultaneous when turning OFF the time of turning OFF switching-means 123A, and switching-means 125A (the following -- the same)
[0025] (4) Next, turn ON switching-means 112A. Thereby, the charge of the capacitor 111 for recovery is charged by the maintenance electrode X through switching-means 112A and a coil 113. at this time, the current on which the switch control means 116 flow a coil 113 detects a bird clapper to 0, and is set to 0 -- it flows through switching-means 114A slowly for a while in this side, and a charge is supplied to the maintenance electrode X through switching-means 114A from the sustaining-voltage supply line Vs And when it is thought that the maintenance electrode X became a sustaining voltage Vs, both switching-means 112A and switching-means 114A are turned OFF.
[0026] A) an address period -- in this period, the X driver 11 is not used but the maintenance electrode X is maintained at the sustaining voltage Vs Moreover, charge recovery / reuse circuit by the side of the Y driver 12 is not used, either. There is comparatively little useless power consumption in this period.
(5) Turn OFF switching-means 341B after turning ON only switching-means 341B and making voltage of the scanning electrode Y1 into GND level. The writing of an indicative data is performed to the 1st display line by address driver which is in this state, for example, is indicated by drawing 5 of JP,5-265397,A. That is, self-elimination electric discharge is performed between the address electrodes and the scanning electrodes Y1 corresponding to the cell which the 1st display line tends to switch off. Next, after turning ON only switching-means 341A and returning the voltage of the scanning electrode Y1 to a sustaining voltage Vs, switching-means 341A is turned OFF.
[0027] Hereafter, same operation is performed in this order about the 2nd - n display line.
S) Turn ON maintenance conducting period (6), next switching-means 112B. Thereby, the charges on the maintenance electrode X are collected through a coil 113 and switching-means 112B by the capacitor 111 for recovery. For a while, the current on which the switch control means 116 flow a coil 113 at this time is detected, and the charge which remained on the maintenance electrode X from which the current concerned is set to 0, and which flows through switching-means 114B slowly

in this side, and cannot be collected is made to discharge to a grand line side, and when it is thought that the maintenance electrode X was set to GND level, both switching-means 112B and switching-means 114B are turned OFF.
[0028] (7) Next, turn ON switching-means 112A. Thereby, the recovery charge of the capacitor 111 for recovery is charged by the maintenance electrode X through switching-means 112A and a coil 113. at this time, the switch control means 116 detect the current which flows a coil 113, and the current concerned is set to 0 -- it flows through switching-means 114A slowly for a while in this side, and a charge is supplied to the maintenance electrode X through switching-means 114A from a sustaining voltage Vs And when it is thought that the maintenance electrode X became a sustaining voltage Vs, both switching-means 112A and switching-means 114A are turned OFF.
[0029] (8) Next, turn ON switching-means 123B and 1261B-126nB. Thereby, charges are collected from the scanning electrodes Y1-Yn through coil 124B and switching-means 123B by the capacitor 122 for recovery. The EMI effect can be decreased when the current which flows coil 124B detects a bird clapper to 0, switch control-means 126B operates so that switching-means 125B may be slowly closed by around the time of the flow of current amounting to 0, and flyback current occurs in the meantime. Next, the charge which remained on the scanning electrode Y1 - Yn is made to discharge to a grand line side through switching-means 125B, turning ON switching-means 125B. And when it is thought that the scanning electrode Y1 was set to GND level, switching-means 123B and switching-means 125B are turned OFF.
[0030] (9) Next, turn ON switching-means 123A. Thereby, the recovery charge of the capacitor 122 for recovery is charged by the scanning electrodes Y1-Yn through switching-means 123A, coil 124A, and diode 1261A-126nA. The current on which switch control-means 126A flows coil 124A at this time detects a bird clapper to 0, and the EMI effect can be decreased, when [to which the flow of current amounts to 0] it flows through switching-means 125A and switching-means 123B slowly for a while in a front hit and flyback current occurs.
[0031] And a charge is supplied to the scanning electrodes Y1-Yn through switching-means 125A turned ON and diode 1261A-126nA from the maintenance electric discharge supply line Vs. And when it is thought that the scanning electrodes Y1-Yn became a sustaining voltage Vs, both switching-means 123A and switching-means 125A are turned OFF. Hereafter, operation of above-mentioned (6) - (9) is repeated.
[0032] In addition, timing which flows through the switching means 114A, 114B, 125A, and 125B mentioned above slowly is taken as the time of output voltage becoming 1/2 or more [of the maximum level] at the time of elevation, or the time or subsequent ones of output voltage becoming 1/2 or less [of the minimum level] at the time of descent. The switching means (switching-means 114B [as opposed to / switching-means 114A / For example,]) which correspond depending on the state of fault if output voltage makes it flow through switching means in 1/2 or less stage of the maximum level at the time of elevation are also because bird clappers are a **** and risk simultaneously at ON. Moreover, it is because a power efficiency is not good in this case, either.
[0033] As mentioned above, in this example, in the circuit which can collect and reuse the charge about charge and discharge also not only in the X driver 11 but in the Y driver 12 with easy composition, when generating of flyback current can be pressed down and flyback current occurs, the EMI effect is decreased. That is, ringing current is removable. In addition, the drive circuit in this example is constituted by a panel and one, and can be used for a plasma display as shown in drawing 10 which is panel display. Furthermore, you may use the panel display for a TV apparatus equipped with a broadcast receive section. By using for a TV apparatus, generating of a noise is pressed down and a flicker of a screen etc. can be reduced. In addition, the TV apparatus which equipped drawing 11 with the broadcast receive section is shown. Moreover, you may use panel display for the computer apparatus which has the processing unit which consists of alter operation equipment, CPUs, etc., such as a keyboard and a mouse. By using the plasma display concerned for a computer apparatus, a noise can be reduced and the effect that possibility that a malfunction will occur decreases arises. The example of a computer apparatus is shown in drawing 12 .
[0034] Moreover, diode as shown in drawing 13 is sufficient as switching-means 1261A-126nA and 1261B-126nB, and which switching means as shown in the views a, b, and 1 c of JP,7-109542,B are sufficient as them.
(Example 2) Next, the example 2 of this invention is explained with reference to drawing 3 .
[0035] Drawing 3 is drawing showing the concrete circuitry of an example 2, and consists of a reactive power recovery circuit 31 and one output circuit 32 of a driver IC. The reactive power recovery circuit 31 The capacitor 3101 for recovery The switching means 3107 and the end of a coil 3104 which connect the high potential side power supply 3105 with the switching means 3102 and switching means 3103 by which parallel connection was carried out, a coil 3104, the high potential side power supply 3105, the low voltage side power supply 3106, and the end of a coil 3104, and the low voltage side power supply 3106 It consisted of a low voltage side power supply 3110 connected with the switching means 3108 and the switch control means 3109 to connect, and the end of the capacitor 3101 for recovery, and is connected with one output circuit 32 of a driver IC through the output 3111 of a reactive power recovery circuit. Moreover, one output circuit 32 of a driver IC consists of an input terminal 3201, switching means 3202 and 3203, high potential side power terminals 3204 of a driver IC, and low voltage side power terminals 3205, and one output circuit 32 of a driver IC is connected to load-carrying capacity 34 from the output terminal 33. In addition, the switch control means 3109 detect the current which flows a coil 3104, and control each switching means by the current.
[0036] In this circuitry, if an input terminal 3201 is controlled and switching means 3202 are turned ON, the output pulse made in the reactive power recovery circuit 31 will be impressed to the electrode of an X-Y-matrix panel. Although capacitance exists in the electrode of a panel, the power accompanying charge and discharge is collected by the reactive power recovery circuit 31. If switching means 3203 are turned ON, an output is fixable to a low. and while collecting charges

to the capacitor 3101 for recovery, the switch control means 3109 decide to detect the current which flows a coil 3104, it detects that the current was set to 0, and the flow of current amounts to 0 -- it flows through switching means 3105 slowly for a while in a front hit The EMI effect can be decreased when flyback current occurs by carrying out this control.
[0037] In addition, the timing which flows through the switching means 3107 and 3108 mentioned above slowly is the same as that of operation of a drive circuit which explained in the example 1, and is taken as the time of output voltage becoming 1/2 or more [of the maximum level] at the time of elevation, or the time or subsequent ones of output voltage becoming 1/2 or less [of the minimum level] at the time of descent. The switching means (switching means [as opposed to / switching means 3107 / For example,] 3108) which correspond depending on the state of fault if output voltage makes it flow through switching means in 1/2 or less stage of the maximum level at the time of elevation are also because bird clappers are a **** and risk simultaneously at ON. Moreover, it is because a power efficiency is not good in this case, either.
[0038] As mentioned above, according to this example, in the circuit in which charge recovery is possible, when flyback current occurs, the EMI effect can be decreased. In addition, the drive circuit in this example is constituted by a panel and one, and can be used for a plasma display as shown in drawing 10 which is panel display. Furthermore, you may use the panel display for a TV apparatus equipped with a broadcast receive section. By using for a TV apparatus, generating of a noise is pressed down and a flicker of a screen etc. can be reduced. In addition, the TV apparatus which equipped drawing 11 with the broadcast receive section is shown. Moreover, you may use panel display for the computer apparatus which has the processing unit which consists of alter operation equipment, CPUs, etc., such as a keyboard and a mouse. By using the plasma display concerned for a computer apparatus, a noise can be reduced and the effect that possibility that a malfunction will occur decreases arises. The example of a computer apparatus is shown in drawing 12 .
[0039] (Example 3) Next, the example 3 of this invention is explained with reference to drawing 4 and drawing 5 . Drawing 4 shows the drive circuit of the plasma display of an example 3. The drive circuit shown in drawing 4 follows the proper voltage impressed to the electrodes 401 and 402 concerned. It is the plasma display which has the memory which can accumulate the charge of the specified quantity, and the electroluminescence function. And in order that the period of a series of display actions displayed on this display may choose two or more cell sections concerned and may perform write-in operation of a proper indicative data, The period which writes an indicative data in the cell section which performs the scan which chooses two or more display lines in line sequential, In the address period S-1 and this address period S-1, the cell section in which this indicative data was written For example, a predetermined period, In the display constituted so that you may make it constitute from a period S-2 which carries out a multiple-times electroluminescence, for example, a maintenance conducting period To each of two power supply lines FVH and FLG which while constitutes two or more this display lines scanned, and are connected to the driver circuit which makes an electrode 402, for example, Y electrode, drive While forming in parallel the driver circuit 400 which consisted of two switching means 403 and 404 Voltage predetermined to at least one side of each power supply line linked to the driver circuit concerned, At least between the 1st state, it operates so that switching means 403 may be in an open state. namely, a power circuit means 410 to impress the 1st power supply line and the switching means 420 to which the predetermined voltage impressed to each power supply line linked to this driver circuit is made to leak -- The signal drawn from a coil 405 is answered after that, and in order [to which the flow of the current of a coil 405 amounts to 0] to cheat to switch-on completely out of a few in a front hit, the switch control means 406 which operate so that switching means 413 may be closed slowly are formed.
[0040] This plasma display concerning this invention performs the display drive of a picture using the X electrode 401, the Y electrode 402, and three electrodes that consist of an address electrode which is not illustrated. That is, it sets in the drive circuit of the plasma display concerning this invention. As opposed to the scanning electrode 402 concerned Y electrode scan driver circuit group 4101 and 4102...410n which consisted of driver circuits which while connects with a driver circuit and give ON voltage (for example, GND) required in order to perform a scan, and OFF voltage (for example, Vsc) to a power supply line (1st power supply line), It is the voltage for a scan at this scanning driver circuit group 4101 and a power supply line common to 4102...410n. this -- with the power circuit means 410 installed in order to supply or intercept the voltage (it is Vsc at the voltage of OFF for example, at the time of a scan) of the 1st power supply means The voltage for this scan impressed to this scanning driver circuit group 4101 and each 4102...410n power supply line is made to leak, and the switching means 420 for setting voltage of this power supply line to 0V or GND are formed.
[0041] Furthermore, the power circuit means 410 in this example In the scanning address period S-1 which is a period which writes an indicative data in the cell section On the other hand, of the two power supply lines FVH and FLG linked to the driver circuit concerned, at least For example, 1st power supply means 410A which makes predetermined voltage, for example, Vsc, impress to FVH1 - FVHn (1st power supply line), Suppose that it consists of the 2nd power supply means 410B which makes predetermined voltage impress to FVH1 concerned - FVHn in the maintenance conducting period S-2 which is a period for predetermined carrying out period electric discharge of the cell section in which the indicative data was written.
[0042] furthermore, it is used in this invention -- this -- 1st power supply means 410A A high-voltage power supply, for example, the 1st voltage generating means 411 and low-battery power supply which generate Vsc, for example, it constitutes from the 2nd voltage generating means 412 to generate GND -- having -- this -- the 1st power supply generating means 411 one power supply line of the two power supply lines (FVH, FLG) linked to the aforementioned driver circuit -- for example it connects with Wiring FVH (1st power supply line) -- having -- this -- the 2nd voltage generating means 412 presupposes that it connects with the power supply line FLG (2nd power supply line), for example, wiring, of another side of the two power supply lines (FVH, FLG) linked to the aforementioned driver circuit

[0043] Switching means 413 and 414 are formed in each of said power supply meanses 411 and 412 used in this invention, respectively, and suppose that it is constituted so that wiring [which / of two power supply lines (FVH1 - FVHn, and FLG1 - FLGn) which connect predetermined voltage to a driver circuit with the predetermined control signal inputted from the outside] (for example, FVH1 - FVHn) may be supplied.
[0044] Furthermore, suppose that the above-mentioned switching means 413 and 414 consist of MOSFETs. furthermore, 1st power supply means 410A in the drive circuit of the display concerning this invention -- this -- suppose that diode, resistance, or its both are connected between one wiring of the two power supply lines linked to the 1st voltage generating means 411 and this driver circuit, for example, FVH, (1st power supply line)
[0045] on the other hand, the power circuit 410 used in the driving gear of the display in this invention is constituted -- this -- 2nd power supply means 410B consists of voltage generating meanses 415 and 416 to generate different potential of two pieces, and each voltage generating meanses 415 and 416 presuppose that the power supply line display line (FVH, FLG) linked to a driver circuit is alike, respectively, and it connects individually
[0046] In this example, 2nd voltage generating means 416 by which connect with the power supply line FVH between two power supply lines linked to a driver circuit, and the 1st voltage generating means 415 which supplies GND potential supplies Vs which is a high voltage is connected to other power supply lines FLG (2nd power supply line) between two power supply lines linked to this driver circuit.
[0047] Furthermore, suppose that it is constituted so that it may supply for any of the power supply line (for example, FVH or FLG) which switching means 417 and 418 are formed, gets down, is inputted into voltage generating meanses 415 and 416 to constitute said 2nd power circuit 410B in this invention, from the outside, respectively, and connects predetermined voltage to this driver circuit with a predetermined control signal being.
[0048] Furthermore, the above-mentioned switching means 417 and 418 presuppose that it consists of MOSFETs. in addition, it described above -- this -- diode D410A and D410B may be connected to parallel at the MOSFET concerned which are the switching means 417 and 418 prepared in each voltage generating meanses 415 and 416 in 2nd power supply means 410B, respectively On the other hand, suppose at each switching means 413 and 414 of the scanning driver circuit by the side of Y electrode that diodes D407 and D408 are connected to parallel, respectively in the drive circuit of the display concerning this invention.
[0049] Moreover, the power supply line linked to the driver circuit by the side of Y electrodes each currently used in this invention is constituted between two power supply lines (FVH, FLG), and connection insertion of the driver circuit 4101 concerned is carried out in parallel with the power supply line (FVH, FLG) of these two books. In addition, it is a common electrode as described above, the electrode, i.e., X electrode, of another side in this display.
[0050] Moreover, the aforementioned leak control switch means 420 used in this invention may have the switching means 421 which consist of MOSFETs, and is connected to the power supply line (FVH) of the side to which the voltage generating means 411 of the above 1st is connected. next, each power supply line (FVH, FLG) which constitutes two power supply lines linked to this driver circuit in the display concerning this invention -- respectively -- being alike -- suppose that the charge recovery circuit 450 is connected
[0051] The charge recovery circuit 450 concerned presupposes that it consists of series resonant circuits with the capacity which a display panel has, and the coils 405 and 451 through diodes D407 and D408. In this invention, it is also possible to set up so that the inductance values of each coils 405 and 451 in the series resonant circuit 450 with this panel capacity constituted by the two sequences concerned and the coil through diode may differ mutually.
[0052] That is, from the peak voltage which generates this charge recovery way at the time of the resonance, it has two L-C resonance paths which consist of diode connected to this, or an MOSFET, and this charge recovery circuit 450 concerning this invention can be clamped to predetermined voltage (Vs or GND), it is stored in the capacitor which carries out the postscript of some of the charges, and uses the charge for the following scanning interval.
[0053] Said 2nd power circuit 410B has a switch function for supplying the current in the case of the maintenance conducting period which repeats display luminescence. In addition, although it is not limited and especially the detailed circuitry of this charge recovery circuit 450 can use a well-known charge recovery circuit conventionally In the example of drawing 1 , diodes D451, D452, D453, D454, D455, D456, D457, and D458 and switches 452 and 453, and also the capacitor 454 are using what consisted of arrays like illustration for everything but coils 405 and 451.
[0054] Although proper drive operation is performed in the drive circuit of the display concerning the above-mentioned this invention on the assumption that the above-mentioned composition While preparing the driver circuit which the fundamental composition of the drive method constituted this cell in the display which has said composition, and was constituted from two transistors by each of one electrode among the electrodes of the couple which discharges The 1st power supply means which makes predetermined voltage impress to each electrode concerned in the period which writes an indicative data in the aforementioned cell section, The 2nd power supply means which makes predetermined voltage impress to each electrode concerned in the period for predetermined carrying out period electric discharge of this cell section in which this indicative data was written, In the display on which the leak control switch means to which the predetermined voltage impressed to each electrode of this is made to leak is established Just before writing an indicative data in this cell section, the 1st power supply means concerned is operated. Just before the end of the period which writes an indicative data for predetermined voltage in the electrode concerned at impression ** bundle ****** and this cell section Stop the operation of the 1st power supply means and this leak control switch means is operated. the period for predetermined carrying out period electric discharge of the process which extinguishes the potential difference during wiring of the electrode concerned, and this cell section --

setting -- this -- it is the drive method which consists of processes which the 2nd power supply means is operated and are impressed to a police box electrode

[0055] Moreover, the potential difference of the both ends of this driver circuit 4101 in the period S-2 for predetermined carrying out period electric discharge of this cell section in which this indicative data was written as other modes of the drive method of this display concerning this invention, i.e., a maintenance conducting period, is maintained to 0, and display processing can be performed. Furthermore, diodes D407 and D408 are connected to each switches 403 and 404 of the driver circuit 4101 concerned at parallel, respectively, and you may make it the maintenance discharge voltage in the maintenance conducting period S-2 concerned make it impressed by the display panel through these diodes D407 and D408 from the 2nd power supply means 410B concerned.

[0056] Furthermore, an output as shown in drawing 5 is obtained by switch control as specifically shows the drive method of the driving gear in this example to drawing 5 . In the switch control shown in drawing 5 , the switch control means 406 and 455 detect the current which flows coils 405 and 451, respectively, and perform control from which the current concerned is set to 0 and which is a front hit for a while and closes switches 411 and 414 slowly, and when they amount to 0, it carries out switch-on completely.

[0057] Timing which begins to make it flow through switches 411 and 414 is similarly taken as the time of output voltage becoming 1/2 or more [of the maximum level] at the time of a rise, or the time or subsequent ones of output voltage becoming 1/2 or less [of the minimum level] at the time of descent with examples 1 and 2 having described. As mentioned above, according to this example, in the circuit in which charge recovery is possible, when flyback current occurs, the EMI effect can be decreased.

[0058] In addition, the drive circuit in this example is constituted by a panel and one, and can be used for a plasma display as shown in drawing 10 which is panel display. Furthermore, you may use the panel display for a TV apparatus equipped with a broadcast receive section. By using for a TV apparatus, generating of a noise is pressed down and a flicker of a screen etc. can be reduced. In addition, the TV apparatus which equipped drawing 11 with the broadcast receive section is shown. Moreover, you may use panel display for the computer apparatus which has the processing unit which consists of alter operation equipment, CPUs, etc., such as a keyboard and a mouse. By using the plasma display concerned for a computer apparatus, a noise can be reduced and the effect that possibility that a malfunction will occur decreases arises. The example of a computer apparatus is shown in drawing 12 .

[0059] (Example 4) Next, the example 4 of this invention is explained with reference to drawing 6 and drawing 7 . Drawing 6 shows the drive circuit of the plasma display of an example 4. IC of a high withstand voltage in which 601 drives a train electrode as for the drive circuit shown in drawing 6 , The terminal with which 602 impresses the direct current voltage for charge recovery of the abbreviation 1/2 for the data voltage Vd, The direct-current-voltage terminal of the data voltage Vd and 604 603 The earth terminal of IC (601), The train electrode from which it is set diode by 605, 606, and 607 and 608 is set as the object of charge recovery, And the capacitor for recovery which has electrostatic capacity with an abbreviation [for the compound electrostatic capacity of an auxiliary capacitor] of 100 or more times, The auxiliary capacitor for 609 making recovery **** small, the coil for charge recovery in 610, The switch control means which detect the current to which 611, 612, and 613 flow to switching means, and 614 flows in a coil, and control opening and closing of switching means by the value of the current, the terminal with which 615 connects a drive circuit with IC (601), and 616 are the terminals of 1 of a data electrode.

[0060] The voltage in the circuit which starts the 4th example of this invention at drawing 7 , a current wave form, etc. are shown. In a period T11, switching means 611 flow, it lets a coil 610, diode 607, and switching means 611 pass, and the charges currently stored in the auxiliary capacitor 609 are collected to the capacitor 608 for recovery. At the time of the end of a period T11, the voltage waveform of a terminal 603 serves as the minimum value near zero. In addition, during this period (T11), even when ON of switching means 612 is also off, they are not cared about. The dashed line of drawing 7 (D) shows this.

[0061] In a period T12, ON of the switching means which are not illustrated in IC (601) and OFF changes are performed. During this period (T12), even when ON of switching means 611 is also off, they are not cared about. The dashed line of drawing 7 (B) shows this. In a period T13, switching means 612 flow and the auxiliary capacitor 609 is charged through diode 606 and a coil 610. Moreover, in parallel to this, a charge is charged by each train electrode through the switching means as which the ON state is chosen for the inside's of switching means 612, diode 606, a coil 610, and IC (601) corresponding to existence of data and which are not illustrated, and a data pulse is formed. Since it charges through a coil 610, the power losses in a circuit are few. The voltage of a terminal 603 rises to near the data voltage Vd.

[0062] some of times of the current on which the switch control means 614 flow a coil being set to 0 at this time -- a front -- detecting -- the -- it begins to flow through switching means 613 slowly for a while at the last time Here, the timing which begins to flow through a switch 613 slowly is after the time of the voltage of the terminal 616 which is output voltage being 1/2 or more [of maximum]. It is because possibility that a power efficiency will become bad and a circuit will short-circuit by fault arises when the voltage of a terminal 616 is 1/2 or less [of maximum].

[0063] In a period T14, switching means 613 are in the state of ON with previous statement. Moreover, the voltage of a terminal 603 is clamped on the data voltage Vd. Moreover, the voltage value of each train electrode is fixed to voltage Vd by the switching means which are not illustrated in IC (601) according to the switching means 613 of an ON state, and the existence of data, and it is fixed to null voltage by the switching means in IC (601). In addition, during this period, even when ON of switching means 612 is also off, they are not cared about. The dashed line of drawing 7 (D) shows this.

[0064] Charge recovery of a data pulse and the writing of data are performed by the above operation. Moreover, the EMI effect is decreased, when generating of flyback current is pressed down and flyback current occurs by performing switch control which it begins to flow through switching means 613 slowly from a last time for a while when reduction of current which flows a coil by the switch control means 614 is detected and it is set to 0. That is, ringing current is removable.
[0065] In addition, the drive circuit in this example is constituted by a panel and one, and can be used for a plasma display as shown in drawing 10 which is panel display. Furthermore, you may use the panel display for a TV apparatus equipped with a broadcast receive section. By using for a TV apparatus, generating of a noise is pressed down and a flicker of a screen etc. can be reduced. In addition, the TV apparatus which equipped drawing 11 with the broadcast receive section is shown. Moreover, you may use panel display for the computer apparatus which has the processing unit which consists of alter operation equipment, CPUs, etc., such as a keyboard and a mouse. By using the plasma display concerned for a computer apparatus, a noise can be reduced and the effect that possibility that a malfunction will occur decreases arises. The example of a computer apparatus is shown in drawing 12 .
[0066] (Example 5) Next, the example 5 of this invention is explained with reference to drawing 8 and drawing 9 . Drawing 8 shows the drive circuit of the plasma display of an example 5. IC of a high withstand voltage in which 801 drives a train electrode as for the drive circuit shown in drawing 8 , The terminal with which 802 impresses the direct current voltage for charge recovery of the abbreviation 1/2 for the data voltage Vd, The terminal for [803] charge recovery of IC (801) in the direct-current-voltage terminal of the data voltage Vd, and 804, The terminal into which 805 inputs the earth terminal of IC (801) into, and 806 inputs the data voltage Vd of IC (801), The train electrode from which it is set as the object for [83 / D / D81-] charge recovery in diode and 807, And the capacitor for charge recovery which has electrostatic capacity with an abbreviation [for the compound electrostatic capacity of an auxiliary capacitor] of 100 or more times, The auxiliary capacitor for 808 making small the rate of change of the recovery electrostatic capacity by change of the electrostatic capacity of the train electrode which should be collected, One of the output terminals of IC (801) by which the coil for charge recovery in 809, and 810, 811, 812, 813 and 814 are connected to switching means, and 815 is connected to each train electrode, and DP81 and DN81 are diodes. 816 is switch control means which perform control slowly flowed through switching means 812 for a while in a front hit when the current which flows a coil 809 is detected and the current concerned is set to 0.
[0067] In addition, much 815 illustrates one of the output terminals connected to one of the existing train electrodes. The voltage waveform in the circuit which starts the 5th example of this invention at drawing 9 etc. is shown. In a period T91, the voltage of the terminal 815 connected to the train electrode which a data pulse is not impressed before a period T91, but should newly impress a data pulse after a period T91 is pulled up, as shown in drawing 9 (F).
[0068] For this reason, it is made to flow through switching means 811, and the charge currently stored in the recovery capacitor 807 is charged at a train electrode through switching means 811, diode D82, a coil 809, switching means 812, and a terminal 815. And it is got blocked, and when the current which charge of the train electrode concerned completes and which flows a coil 809 is set to 0, the switch control means 816 begin to flow through switching means 814 slowly for a while in this side. In addition, the switch control means 816 detect the current which flows a coil 809, judge that it is this side a few at the time of the current concerned being set to 0, and begin to flow through switching means 814. The timing which flows through these switching means 814 is a time of output voltage, i.e., the voltage of a terminal 815, being 1 / after two of the maximum level like ****. According to the experiment, the time of about 75% of the maximum level of output voltage (voltage of a terminal 815) has the viewpoint of energy efficiency and EMI prevention to desirably good convenience.
[0069] In a period T92, since the switching means 813 in IC (801) are made off and the switching means 814 in IC (801) are succeedingly set to ON, a data pulse voltage is clamped on the data voltage Vd. In addition, in order that switching means 813 and 814 may carry out operation which conflicts mutually, when switching means 813 are ON (or OFF), switching means 814 are OFF (or ON).
[0070] In a period T93, since the following data pulse exists, the pulse voltage of a terminal 815 does not change. For this reason, in switching means 812, switching means 814 consider switching means 813 as as [of an OFF state] with an ON state with an OFF state. Since the voltage of a terminal 815 is still the data voltage Vd also in a period T94, the state of switching means 812, 814, and 815 is not changed.
[0071] In a period T95, the data pulse is impressed before the period T95, and the voltage of the terminal 815 connected with the train electrode which newly removes a data pulse after a period T95 is reduced (drawing 9 (F)). For this reason, it is made to flow through switching means 812, and the charges currently stored in the train electrode are collected to the capacitor 807 for recovery through a terminal 815, switching means 812, a coil 809, diode D83, and switching means 810.
[0072] And the time of finishing collecting to the capacitor 807 for recovery, i.e., when the current which flows a coil 809 is set to 0, begins to flow through switching means 813 slowly in front for a while. In addition, it detects that it is a front a few at the time of the current on which the switch control means 816 flow a coil 809 being set to 0, and the above switching means 813 are controlled.
[0073] thus, in this example, in the data pulse driver circuit which can heighten the laborsaving effect of a data pulse remarkably, and can realize high-speed operation, when generating of flyback current can be pressed down and flyback current occurs, decrease little of the EMI effect is carried out That is, ringing current is removable. In addition, the drive circuit in this example is constituted by a panel and one, and can be used for a plasma display as shown in drawing 10 which is panel display. Furthermore, you may use the panel display for a TV apparatus equipped with a broadcast receive section. By using for a TV apparatus, generating of a noise is pressed down and a flicker of a screen etc. can be reduced. In addition, the TV apparatus which equipped drawing 11 with the broadcast receive section is shown. Moreover, you may use panel

display for the computer apparatus which has the processing unit which consists of alter operation equipment, CPUs, etc., such as a keyboard and a mouse. By using the plasma display concerned for a computer apparatus, a noise can be reduced and the effect that possibility that a malfunction will occur decreases arises. The example of a computer apparatus is shown in drawing 12 .

[0074]

[Effect of the Invention] As explained above, according to the plasma display drive circuit in this invention, the EMI effect is decreased in order [from which the current which flows an inductor for an energy recovery is set to 0] to begin to control the switch for a voltage clamp by this side for a while. Moreover, ringing current is removable. That is, it can prevent that the flyback current which carried out Perilla frutescens (L.) Britton var. crispa (Thunb.) Decne. of the correctly controllable energy recovery possible, and was generated in guidance does influence disadvantageously for the pixel position of a panel.

[Translation done.]

* NOTICES *

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TECHNICAL FIELD

[The technical field to which invention belongs] It is related with the various equipments using the thing about the circuit which prevents that the flyback current which this invention enabled a plasma display drive circuit and correctly controllable especially charge recovery, and was generated in guidance does influence disadvantageously for the pixel position of a panel, and the circuit concerned.

[Translation done.]

PRIOR ART

[Description of the Prior Art] As the 1st conventional technology, there is a publication-number No. 265397 [five to] official report. Since a charge was mutually collected and reused also about the charge and discharge to the scanning electrodes Y1-Yn using the common capacitor, the 1st, and 2nd coils to the independent scanning electrodes Y1-Yn according to the conventional technology of **** 1, it was what does so the effect that charge recovery is attained with easy composition.
[0003] Moreover, there is a publication-number No. 249916 [five to] official report as the 2nd conventional technology. in the circuit which drives a capacitive load with low power, since the Prior art of **** 2 had connected the invalid charge recovery circuit which used the inductor for one power terminal, it was what does so the effect that the recovery which is the charge which exists in a scanning electrode and a data electrode is attained Moreover, there is a publication-number No. 160901 [eight to] official report as the 3rd conventional technology. The Prior arts of **** 3 are two or more scanning electrodes which were formed in the coplanar and which are mutually parallel. In the drive circuit of the display panel which impresses a data pulse to the data electrode of the display panel equipped with two or more data electrodes which are insulated with the scanning electrode concerned, intersect perpendicularly with the scanning electrode concerned, and are mutually parallel at least Have the capacitor and auxiliary capacitor of the aforementioned charge recovery, and between the end of the capacitor for the aforementioned charge recovery, and the data voltage input terminal which supplies data voltage to IC which drives the aforementioned data electrode When the switching means which make the current of the sense which collects charges energize are prepared, an auxiliary capacitor is connected between a data voltage input terminal and grounding and the other end of the capacitor for charge recovery has the charge recovery circuit of the data pulse grounded It was what can respond also to the display panel of which high-speed operation is required like a plasma panel.
[0004] Furthermore, there is a publication-number No. 160219 [seven to] official report as the 4th conventional technology. while the Prior art of **** 4 prepares the driver circuit which is the push pull type constituted from two transistors by each of two power supply line pairs linked to the driver circuit which drives two or more display electrodes scanned in the driving gear of AC type flat-surface display constituted by the electrode group arranged in the shape of a matrix By establishing the leak control switch means to which the predetermined charge which connected with each driver circuit and was impressed to the power circuit means and power supply line which impress predetermined voltage to a power supply line is made to leak, pressure-proofing was low, high-speed sequential scanning was possible, and it was what can perform charge recovery.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, according to the plasma display drive circuit in this invention, the EMI effect is decreased in order [from which the current which flows an inductor for an energy recovery is set to 0] to begin to control the switch for a voltage clamp by this side for a while. Moreover, ringing current is removable. That is, it can prevent that the flyback current which carried out Perilla frutescens (L.) Britton var. crispa (Thunb.) Decne. of the correctly controllable energy recovery possible, and was generated in guidance does influence disadvantageously for the pixel position of a panel.

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, the "flyback" changes by the side of charge recovery of the inductor used in order to carry out the trigger of the flow of an output driver are made generated in the circuit shown in such the conventional 1st mentioned above - the 4th technology. Moreover, the flyback current for controlling a maintenance driver makes the side effect that current is pulled out from a panel generated, while an output driver is flowing. Ringing current is generated for this side effect. That is, a voltage flyback will occur in the recovery side of an inductor in the end of a resonance cycle. Inductor voltage is the compulsive voltage and the retrose which were impressed first. It flows in order to make flyback current in agreement with panel voltage and to charge or discharge the capacity by the side of recovery of an inductor. The increase in the unrecoverable charge which a charge is transmitted in the direction contrary to working [the] and the changes demanded, consequently is wasted by the circuit, and the technical problem that a noise occurred when an output driver flows occurred.

[0006] this invention solves the above-mentioned technical problem, detects the current which flows a coil for the reason, has the composition of having the switch control means which control switching means by the value of the current, and carries out the following operation. These switch control means have a secondary winding, and the secondary winding concerned produces the voltage which is proportional to voltage at the moment of starting a coil. If current flows into panel capacity through a coil, when panel voltage becomes equal to driver voltage, the voltage concerning a coil will decrease to zero. In order that the energy accumulated at the coil may charge panel capacity further, it is made for current to continue flowing. If panel voltage exceeds driver voltage and it goes up, it will reverse and the polarity of the voltage of a coil will increase with panel voltage. It is used for this polar change and a power surge being taken over to a secondary coil, and making it flow through each output driver. The flow of an output driver is restricted by gate resistance. This restricts the current on which the capacity of MOSFET flows through the MOSFET, transmitting the energy to which the coil has stopped at it to a panel. Since a polar change will surely be produced before it can flow through an output driver, as for the total amount of the energy transmitted with the coil, even the basis of a change capacitive load is always maximized. Since the output driver flowed slowly, and it has fully flowed when a flyback happens, the EMI effect is decreased. This removes the ringing current which appears in a Prior art.

[0007] Correctly controllable charge recovery is enabled by this, and the flyback current generated in guidance aims at preventing doing influence disadvantageously for the pixel position of a panel.

[Translation done.]

MEANS

[Means for Solving the Problem] In order to solve the above-mentioned technical problem the technical means of this invention The means for switching which combine scanning voltage and an electric discharge sustaining voltage with a scanning electrode alternatively, An inductor means by which the 2nd terminal is connected to all scanning electrodes through means for switching, A source means of driver voltage to supply driver voltage, and a voltage supply means to supply the electric discharge sustaining voltage which shows a bigger voltage value than driver voltage, The 2nd switching means which combine alternatively the 2nd terminal and voltage supply means of an inductor means, The 1st switching means which combine alternatively the 1st terminal and source means of driver voltage of an inductor means according to change of an input signal, In the situation chosen so that the switch control means which answer the size of the current which flows for an inductor means may be provided and means for switching may combine an electric discharge sustaining voltage with the aforementioned scanning electrode Between charge states, the 1st switching means will combine the source means of driver voltage with the 1st terminal of an inductor means, if an input signal carries out 1st change. The 1st current which charges the capacity of a scanning electrode through an inductor means arises. It causes that an inductor means reaches the voltage on which a scanning electrode exceeds driver voltage, and the 1st current decreases toward zero soon. switch control means The size of the current which changes the 2nd switching means into an open state until very recently, and flows for an inductor means from which the 1st current returns to zero at least is answered. It makes flow slowly from before and begins. the above a few with which the flow of the 1st current reaches zero in the 2nd switching means -- When reaching zero, it is completely made switch-on and the 2nd switching means are closed, and a voltage supply means supplies both flyback current to the discharge current and the inductor means to a scanning electrode between the electric discharge maintenance states following it.

[0009] Moreover, the 3rd switching means with which this invention combines alternatively the 1st terminal and source means of driver voltage of an inductor means according to change of the 2nd of an input signal, The 4th switching means which combine alternatively the 2nd terminal and source of common potential of an inductor means are provided further. the 3rd switching means If an input signal carries out 2nd change, the source means of driver voltage will be combined with the 1st terminal of an inductor means. The 2nd discharging current produces the capacity of a scanning electrode through an inductor means. It causes that an inductor means reaches the voltage on which a scanning electrode is less than driver voltage, and the 2nd current decreases toward zero soon. switch control means The size of the current which changes the 4th switching means into an open state until very recently, and flows for an inductor means from which the 2nd current returns to zero at least is answered. It makes flow slowly from before and begins. the above a few with which the flow of the 2nd current reaches zero in the 4th switching means -- When reaching zero, it is completely made switch-on and the 4th switching means are closed, and the source of common potential serves as an electric discharge way to panel capacity while flowing the flyback current from an inductor means.

[0010] Moreover, the data electrode driving means which this invention combines each of a data electrode with the 2nd terminal of an inductor means alternatively, and drive a data electrode, A source means of driver voltage to supply driver voltage, and a voltage supply means to supply the data voltage which shows a bigger voltage value than driver voltage, The 1st switching means which combine alternatively the 1st terminal and source means of driver voltage of an inductor means according to change of the 3rd of an input signal, The switch control means which answer the size of the current which flows for an inductor means are provided. data electrode driving means The 5th switching means which combine alternatively the data electrode which should be made to discharge, and the 2nd terminal of an inductor means, It has the 2nd switching means which make it flow through the data electrode combined with the 2nd terminal of an inductor means by the 5th switching means, and a voltage supply means alternatively. the 1st switching means If an input signal changes, the source means of driver voltage will be combined with the 1st terminal of the aforementioned inductor means. The 1st current which charges the capacity of the data electrode combined by the 5th switching means through the inductor means arises. It causes that an inductor means reaches the voltage on which a data electrode exceeds driver voltage, and the 1st current decreases toward zero soon. switch control means The size of the current which changes the 2nd switching means into an open state until very recently, and flows for an inductor means from which the 1st current returns to zero at least is answered. It makes flow slowly from before and begins. the above a few with which the flow of the 1st current reaches zero in the 2nd switching means -- When reaching zero, it is completely made switch-on and the 2nd switching means are closed, and a voltage supply means supplies both flyback current to the discharge current and the aforementioned inductor means to a data electrode between the voltage maintenance states following it.

[0011] Furthermore, the 3rd switching means which combine alternatively the 1st terminal and source means of driver voltage of an inductor means according to change of the 4th of an input signal, The 4th switching means which make it flow through the aforementioned data electrode which is combined with the 2nd terminal of an inductor means by the 5th switching means in data electrode driving means, and the source of common potential alternatively are provided further. The 3rd switching means will combine the source means of driver voltage with the 1st terminal of an inductor means, if an input signal carries out 4th change. The 2nd discharging current produces the capacity of a scanning electrode through an inductor means. It causes that an inductor means reaches the voltage on which a scanning electrode is less than driver voltage, and the 2nd current decreases toward zero soon. switch control means The size of the current which changes the 4th switching means into an open state until very recently, and flows for an inductor means from which the 2nd current returns to zero at least is answered. It makes flow slowly from before and begins. the above a few with which the flow of the 2nd current reaches zero in the 4th switching means -- When reaching zero, it is completely made switch-on and the 4th switching means are closed, and the source of common potential serves as an electric discharge way to data electrode capacitance while flowing the flyback current from the aforementioned inductor means.

[0012]

[Embodiments of the Invention] In order to solve the above-mentioned technical problem, this invention detects the current which flows a coil in a plasma display drive circuit. It is a thing about the plasma display equipment possessing the thing which added the switch control means which control switching means by the value of the current, and the plasma display drive circuit concerned, the TV apparatus using the equipment, and a computer apparatus. By carrying out control which makes the switching means concerned switch-on completely [when the current which flows a coil by the aforementioned switch control means begins to make it flow through the switching means which reach zero, and which correspond from before for a while slowly and reaches zero] Since it has fully flowed when a flyback happens, the EMI effect can be decreased.

[0013] it can prevent that the flyback current which enabled correctly controllable charge recovery by this, and was generated in guidance does influence disadvantageously for the pixel position of a panel -- it is

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[Translation done.]

EXAMPLE

[Example] Hereafter, the example of this invention is explained based on an accompanying drawing.
(Example 1) Drawing 1 shows the important section circuitry of the X driver 11 of an example 1, and the Y driver 12. The X driver 11 is equipped with the capacitor 111 for recovery for charge recovery / reuse, the bidirectional switch 112, a coil 113, the switching means 114 for a maintenance pulse auxiliary output, the switching means 115 for a whole surface write-pulse output, and the switch control means 116 to the maintenance electrode X. The switch control means 116 detect the time of the current which flows a coil 113 becoming zero, and carry out control which becomes zero and which changes switching means 114A and 114B a little in this side. Moreover, there are two switching means 112A and 112B among the bidirectional switching means 112, and they have composition by which parallel connection was carried out. Moreover, there are two switching means 114A and 114B also in the switching means 114 for a maintenance pulse auxiliary output.
[0015] The end is connected to a grand line and, as for the capacitor 111 for recovery, the other end is connected to the maintenance electrode X through the bidirectional switching means 112 and the coil 113. Moreover, it connects with the sustaining-voltage supply line Vs through switching-means 114A, and connects with a grand line through switching-means 114B, and the maintenance electrode X is written in through switching means 115, and is connected to the voltage supply line Vw.
[0016] The example of concrete composition of the bidirectional switching means 112 and switching means 114 is explained to JP,5-265397,A. The Y driver 12 is equipped with the switch control means 126A and 126B which are combined with the semiconductor integrated circuit 121 for an indicative-data write pulse and maintenance pulse outputs, and the exterior of a semiconductor integrated circuit 121 by the capacitor 122 for recovery for power recovery / reuse, switching-means 123A, switching-means 123B, Coils 124A and 124B, switching-means 125A, switching-means 125B, and Coils 124A and 124B, and answer the flow of current to the scanning electrodes Y1-Yn.
[0017] The end is connected to a grand line, on the other hand, the other end is connected to the sustaining-voltage supply line Vs through switching-means 123A, coil 124A, and switching-means 125A, and, on the other hand, the capacitor 122 for recovery is connected to the grand line through switching-means 123B, coil 124B, and switching-means 125B. The current which charges the panel capacity of a scanning electrode through coil 124A produces switching-means 123A during combination, it causes that coil 124A reaches the voltage on which a panel terminal exceeds driver voltage, and current amounts to 0 on the point.
[0018] Moreover, switch control-means 126A operates so that switching-means 125A may be in an open state to the scanning electrodes Y1-Yn between charge states about a charge, the signal drawn from coil 124A is answered after that, and in order to which the flow of the current of coil 124A amounts switching-means 125A to 0] to cheat to switch-on completely out of a few in a front hit, it operates so that switching-means 125A may be closed slowly. The sustaining-voltage supply line Vs supplies both the current to a panel terminal, and the flyback current to coil 124A between the following states. Furthermore, it operates so that, as for switch control-means 126B, switching-means 125B may be in an open state between the electric discharge maintenance states of the charge of the scanning electrodes Y1-Yn, the signal drawn from coil 124B is answered after that, and in order [to which the flow of the current of coil 124B amounts switching-means 125B to 0] to cheat to switch-on completely out of a few in a front hit, it operates so that switching-means 125B may be closed slowly.
[0019] By connecting the node of coil 124A and switching-means 125A common to switching-means 1261A-126nA, the node of coil 124B and switching-means 125B is connected to switching-means 1261B-126nB, and it connects with the scanning electrode Yi, and connects with the connection of switching-means 34iA and switching-means 34iB. In addition, switching-means 1261A-126nA and 1261B-126nB function on a scanning electrode as means for switching which combine scanning voltage and an electric discharge sustaining voltage alternatively.
[0020] In addition, the capacitors 111 and 122 for recovery are both 10 micro F which is 100 or more times of CP more fairly than the full capacity CP between the maintenance electrode X and the scanning electrodes Y1-Yn greatly, and it is made for there to be almost no voltage variation in the case of charge recovery / reuse. In the following explanation, both the voltage between terminals of the capacitors 111 and 122 for recovery is Vs/2.
[0021] Next, the case where the voltage waveform which shows an example of operation of the constituted this example to drawing 2 is impressed to the maintenance electrode X and the scanning electrodes Y1-Yn is explained like the above.
W) Both the switching means [and] 112A, 112B, 114A, 114B, 115, 123A, 123B, 125A, and 125B, 1261A-126nA [and], and 1261B-126nB both presuppose at the complete write-in period beginning that OFF, the maintenance electrode X, and the scanning electrodes Y1-Yn are a sustaining voltage Vs.

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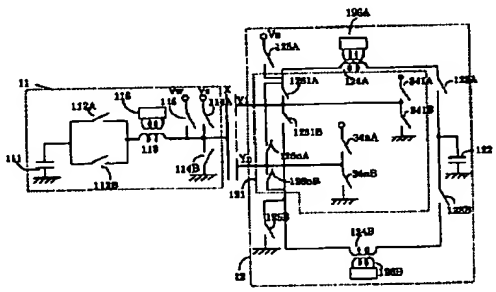
(54) PLASMA DISPLAY DRIVING CIRCUIT AND PLASMA DISPLAY DEVICE

(57) Abstract:

PROBLEM TO BE SOLVED: To prevent an inductively generated flyback current from affecting on pixel positions adversely by performing a control starting the bringing of switching means into conduction a little before a current flowing through a coil reaches zero and bringing them into conduction states completely when the current reaches zero.

SOLUTION: The recovered electric charge of a capacitor 122 for recovery is charged on scanning electrodes Y1-Yn through a switching means 123A, a coil 124A and diodes 1261A-126nA. At this time, a switching control means 126A detects that a current flowing through the coil 124A becomes zero and it brings a switching means 125A and the switching means into conduction slowly about a little before the current reaches zero. As a result, since these switching means are sufficiently conducting when a flyback is to be generated, an EMI effect can be reduced. Thus, the recovering of electric charge which can be correctly controlled is made possible. Moreover, a ringing current can be eliminated.



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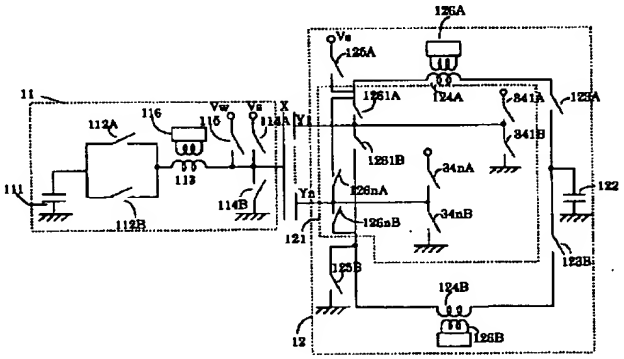
(54)【発明の名称】　プラズマディスプレイ駆動回路およびプラズマディスプレイ装置

(57)【要約】

【課題】　出力ドライバの導通をトリガするために使われるインダクタの電荷回収側の“フライバック”遷移の発生により、リンギング電流を発生するという課題があった。

【解決手段】　本発明は、走査電圧と放電維持電圧を選択的に結合する切換手段と、インダクタ手段と、駆動電圧源手段と、電圧供給手段と、インダクタ手段の第２の端子と電圧供給手段を選択的に結合する第２のスイッチ手段と、インダクタ手段の第１の端子と駆動電圧源手段を入力信号の変化に応じて選択的に結合する第１のスイッチ手段と、インダクタ手段に流れる電流の大きさに応答するスイッチ制御手段とを具備し、スイッチ制御手段は第１の電流が０に戻る少し前までは第２のスイッチ手段を開状態にし、第２のスイッチ手段を第１の電流の流れが０に達する少し前から導通させ始め、０に達する時には完全に導通状態とし第２のスイッチ手段を閉じる、という制御を行う。



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【特許請求の範囲】

【請求項１】プラズマディスプレイの走査電極を並列に放電維持駆動する回路であって、前記走査電極に走査電圧と放電維持電圧を選択的に結合する切換手段と、前記切換手段を介して全走査電極に第２の端子が接続されるインダクタ手段と、駆動電圧を供給する駆動電圧源手段と、前記駆動電圧より大きな電圧値を示す放電維持電圧を供給する電圧供給手段と、前記インダクタ手段の第２の端子と前記電圧供給手段を選択的に結合する第２のスイッチ手段と、前記インダクタ手段の第１の端子と前記駆動電圧源手段を入力信号の変化に応じて選択的に結合する第１のスイッチ手段と、前記インダクタ手段に流れる電流の大きさに応答するスイッチ制御手段と、を具備し、前記切換手段が、放電維持電圧を前記走査電極に結合するよう選択している状況において、充電状態の間、前記第１のスイッチ手段は、入力信号が第１の変化をすると前記駆動電圧源手段を前記インダクタ手段の第１の端子に結合し、前記インダクタ手段を通して前記走査電極の容量を充電する第１の電流が生じ、前記インダクタ手段は前記走査電極が前記駆動電圧を超える電圧に達することを引き起こし、やがて前記第１の電流はゼロに向かって減少し、前記スイッチ制御手段は、少なくとも前記第１の電流がゼロに戻る少し前までは前記第２のスイッチ手段を開状態にし、前記インダクタ手段に流れる電流の大きさに応答して、第２のスイッチ手段を前記第１の電流の流れがゼロに達する前記少し前から導通させ始め、ゼロに達するときには完全に導通状態にして前記第２のスイッチ手段を閉じ、それにつづく放電維持状態の間、前記電圧供給手段は前記走査電極への放電電流と前記インダクタ手段へのフライバック電流の両方を供給することを特徴とするプラズマディスプレイ駆動回路。

【請求項２】インダクタ手段の第１の端子と駆動電圧源手段を入力信号の第２の変化に応じて選択的に結合する第３のスイッチ手段と、前記インダクタ手段の第２の端子と共通電位源を選択的に結合する第４のスイッチ手段とをさらに具備し、前記第３のスイッチ手段は、入力信号が第２の変化をすると前記駆動電圧源手段を前記インダクタ手段の第１の端子に結合し、前記インダクタ手段を通して走査電極の容量を放電する第２の電流が生じ、前記インダクタ手段は前記走査電極が前記駆動電圧を下回る電圧に達することを引き起こし、やがて前記第２の電流はゼロに向かって減少し、前記スイッチ制御手段は、少なくとも前記第２の電流がゼロに戻る少し前までは前記第４のスイッチ手段を開状態にし、前記インダクタ手段に流れる電流の大きさに応答して、第４のスイッチ手段を前記第２の電流の流れがゼロに達する前記少し前から導通させ始め、ゼロに達するときには完全に導通状態にして前記第４のスイッチ手段を閉じ、前記共通電位源は、前記インダクタ手段からのフライバック電流を流入するとともに、前記パネル容量に対して放電路となることを特徴とする請求項１記載のプラズマディスプレイ駆動回路。

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【請求項３】切換手段が、インダクタ手段の第２の端子と各走査電極をそれぞれ陽極がインダクタ手段の第２の端子、陰極が走査電極と結合されたダイオードを含むことを特徴とする請求項１記載のプラズマディスプレイ駆動回路。

【請求項４】切換手段が、各走査電極とインダクタ手段の第２の端子をそれぞれ陽極が走査電極、陰極がインダクタ手段の第２の端子と結合されたダイオードを含むことを特徴とする請求項２記載のプラズマディスプレイ駆動回路。

【請求項５】切換手段が、ダイオードと並列接続されたスイッチ手段を含むことを特徴とする請求項３記載のプラズマディスプレイ駆動回路。

【請求項６】切換手段が、ダイオードと並列接続されたスイッチ手段を含むことを特徴とする請求項４記載のプラズマディスプレイ駆動回路。

【請求項７】プラズマディスプレイのデータ電極を選択的に並列に駆動する回路であって、

前記データ電極のそれぞれをインダクタ手段の第２の端子と選択的に結合しデータ電極を駆動するデータ電極駆動手段と、駆動電圧を供給する駆動電圧源手段と、前記駆動電圧より大きな電圧値を示すデータ電圧を供給する電圧供給手段と、前記インダクタ手段の第１の端子と前記駆動電圧源手段を入力信号の変化に応じて選択的に結合する第１のスイッチ手段と、前記インダクタ手段に流れる電流の大きさに応答するスイッチ制御手段と、を具備し、前記データ電極駆動手段は、放電させるべき前記データ電極と前記インダクタ手段の第２の端子を選択的に結合する第５のスイッチ手段と、前記第５のスイッチ手段により前記インダクタ手段の第２の端子と結合されている前記データ電極と前記電圧供給手段とを選択的に導通させる第２のスイッチ手段を有し、前記第１のスイッチ手段は、入力信号が第３の変化をすると前記駆動電圧源手段を前記インダクタ手段の第１の端子に結合し、前記インダクタ手段を通して前記第５のスイッチ手段により結合されている前記データ電極の容量を充電する第１の電流が生じ、前記インダクタ手段は前記データ電極が前記駆動電圧を超える電圧に達することを引き起こし、やがて前記第１の電流はゼロに向かって減少し、前記スイッチ制御手段は、少なくとも前記第１の電流がゼロに戻る少し前までは前記第２のスイッチ手段を開状態にし、前記インダクタ手段に流れる電流の大きさに応答して、第２のスイッチ手段を前記第１の電流の流れがゼロに達する前記少し前からゆっくり導通させ始め、ゼロに達するときには完全に導通状態にして前記第２のスイッチ手段を閉じ、前記電圧供給手段は、それにつづく電圧維持状態の間、前記データ電極への放電電流と前記インダクタ手段へのフライバック電流の両方を供給するこ

とを特徴とするプラズマディスプレイ駆動回路。

【請求項８】第２のスイッチ手段は、一端が電圧供給手段、他端がインダクタ手段の第２の端子に接続され、電圧維持状態の間、第５のスイッチ手段を経由してデータ電極への放電電流を供給することを特徴とする請求項７記載のプラズマディスプレイ駆動回路。

【請求項９】第２のスイッチ手段が、各データ電極に共通に１つ設けられていることを特徴とする請求項８記載のプラズマディスプレイ駆動回路。

【請求項１０】第２のスイッチ手段は、一端が電圧供給手段、他端がデータ電極に接続され、電圧維持状態の間、第５のスイッチ手段を経由して前記インダクタ手段へのフライバック電流を供給することを特徴とする請求項７記載のプラズマディスプレイ駆動回路。

【請求項１１】インダクタ手段の第１の端子と駆動電圧源手段を入力信号の第４の変化に応じて選択的に結合する第３のスイッチ手段と、前記データ電極駆動手段に、第５のスイッチ手段によりインダクタ手段の第２の端子と結合されている前記データ電極と共通電位源とを選択的に導通させる第４のスイッチ手段をさらに具備し、前記第３のスイッチ手段は、入力信号が第４の変化をすると前記駆動電圧源手段を前記インダクタ手段の第１の端子に結合し、前記インダクタ手段を通して走査電極の容量を放電する第２の電流が生じ、前記インダクタ手段は前記走査電極が前記駆動電圧を下回る電圧に達することを引き起こし、やがて前記第２の電流はゼロに向かって減少し、前記スイッチ制御手段は、少なくとも前記第２の電流がゼロに戻る少し前までは前記第４のスイッチ手段を開状態にし、前記インダクタ手段に流れる電流の大きさに応答して、第４のスイッチ手段を前記第２の電流の流れがゼロに達する前記少し前から導通させ始め、ゼロに達するときには完全に導通状態にして前記第４のスイッチ手段を閉じ、前記共通電位源は、前記インダクタ手段からのフライバック電流を流入するとともに、前記データ電極容量に対して放電路となることを特徴とする請求項７記載のプラズマディスプレイ駆動回路。

【請求項１２】第４のスイッチ手段は、一端が共通電位源、他端がインダクタ手段の第２の端子に接続され、第５のスイッチ手段を経由してデータ電極容量に対して放電路となることを特徴とする請求項１１記載のプラズマディスプレイ駆動回路。

【請求項１３】第２のスイッチ手段が、各データ電極に共通に１つ設けられていることを特徴とする請求項1.2記載のプラズマディスプレイ駆動回路。

【請求項１４】第２のスイッチ手段は、一端が共通電位源、他端がデータ電極に接続され、第５のスイッチ手段を経由して前記インダクタ手段からのフライバック電流を流入することを特徴とする請求項１１記載のプラズマディスプレイ駆動回路。

【請求項１５】インダクタ手段の第２の端子と共通電位源との間にバラストコンデンサを接続することを特徴とする請求項７～１４のいずれかに記載のプラズマディスプレイ駆動回路。

【請求項１６】駆動電圧源手段の電圧が電圧供給手段の電圧の約１／２であることを特徴とする請求項１～１４のいずれかに記載のプラズマディスプレイ駆動回路。

【請求項１７】スイッチ制御手段がインダクタ手段と誘導結合されていることを特徴とする請求項１～１４のいずれかに記載のプラズマディスプレイ駆動回路。

【請求項１８】スイッチ制御手段が、走査電極が駆動電圧を超える電圧値を示してから第１の電流がゼロに達するまでの期間だけ第２のスイッチ手段を閉じさせる第１のセンス回路を有することを特徴とする請求項１又は７記載のプラズマディスプレイ駆動回路。

【請求項１９】インダクタ手段の第１の端子と電圧供給手段との間に結合されフライバック電流を消滅させる抵抗性の浪費手段を含んだフライバックリターン回路をさらに具備することを特徴とする請求項１又は７記載のプラズマディスプレイ駆動回路。

【請求項２０】スイッチ制御手段が、走査電極が駆動電圧より低い電圧値を示してから第２の電流がゼロに達するまでの期間だけ第４のスイッチ手段を閉じさせる第２のセンス回路を有することを特徴とする請求項２又は１１記載のプラズマディスプレイ駆動回路。

【請求項２１】インダクタ手段の第１の端子と共通電圧源との間に結合されフライバック電流を消滅させる抵抗性の浪費手段を含んだフライバックリターン回路をさらに具備することを特徴とする請求項２又は１１記載のプラズマディスプレイ駆動回路。

【請求項２２】データ電極に代えて走査電極、データ電圧に代えて走査電圧とすることを特徴とする請求項７～２１のいずれかに記載のプラズマディスプレイ駆動回路。

【請求項２３】走査電圧に代えて放電維持電圧とすることを特徴とする請求項２２記載のプラズマディスプレイ駆動回路。

【請求項２４】切換手段が、インダクタ手段の第２の端子と各走査電極をそれぞれ陽極がインダクタ手段の第２の端子、陰極が走査電極と結合されたダイオード、ならびに、各走査電極とインダクタ手段の第２の端子をそれぞれ陽極が走査電極、陰極がインダクタ手段の第２の端子と結合されたダイオード、さらにそれぞれのダイオードと並列接続されたスイッチ手段を含む請求項３記載のプラズマディスプレイ駆動回路に、さらに、ダイオードに並列接続されたスイッチ手段にかかる所定の電圧をリークするリークスイッチ手段を有することを特徴とするプラズマディスプレイ駆動回路。

【請求項２５】請求項１～２４のいずれか記載のプラズマディスプレイ駆動回路と、同一平面上に形成した互いに並行する複数本の走査電極と前記走査電極に並行して

形成された放電維持電極と、前記走査電極ならびに放電維持電極と絶縁されて直交し互いに並行する複数のデータ電極とを少なくとも備えたプラズマディスプレイを具備することを特徴とするプラズマディスプレイ装置。

【請求項２６】請求項２５記載のプラズマディスプレイ装置と放送受信装置を備えたことを特徴とするテレビジョン装置。

【請求項２７】請求項２５記載のプラズマディスプレイ装置と入力操作装置と演算処理装置を備えたことを特徴とするコンピュータ装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、プラズマディスプレイ駆動回路、特には、正確に制御できる電荷回収を可能にし、そして誘導的に発生したフライバック電流がパネルの画素位置に不利に影響を及ぼすことを防止する回路に関するものおよび当該回路を用いた各種装置に関するものである。

【０００２】

【従来の技術】従来の第１の技術として、特開平５－２６５３９７号公報がある。本第１の従来技術によれば、互いに独立な走査電極Ｙ１～Ｙｎに対し共通のコンデンサ、第１及び第２のコイルを用いて、走査電極Ｙ１～Ｙｎに対する充放電に関しても電荷を回収し再利用することができるため、簡単な構成で電荷回収が可能になるという効果を奏するものであった。

【０００３】また、従来の第２の技術として、特開平５－２４９９１６号公報がある。本第２の従来の技術は、容量性負荷を低電力にて駆動する回路において、一方の電源端子にインダクタを用いた無効電荷回収回路を接続しているために、走査電極、データ電極に存在する電荷の回収が可能になるという効果を奏するものであった。また、従来の第３の技術として、特開平８－１６０９０１号公報がある。本第３の従来の技術は、同一平面上に形成した互いに平行する複数の走査電極と、当該走査電極と絶縁され、当該走査電極と直交し互いに平行する複数のデータ電極とを少なくとも備えた表示パネルのデータ電極にデータパルスを印加する表示パネルの駆動回路において、前記電荷回収のコンデンサと、補助コンデンサとを備え、前記電荷回収用のコンデンサの一端と、前記データ電極を駆動するＩＣにデータ電圧を供給するデータ電圧入力端子との間に、電荷を回収する向きの電流を通電させるスイッチ手段を設け、データ電圧入力端子と接地との間に補助コンデンサを接続し、電荷回収用のコンデンサの他端は接地されているデータパルスの電荷回収回路を有することにより、プラズマパネルのように高速動作を要求される表示パネルにも対応できるものであった。

【０００４】さらに、従来の第４の技術として、特開平７－１６０２１９号公報がある。本第４の従来の技術

は、マトリックス状に配置された電極群により構成されるＡＣ型平面表示装置の駆動装置において、走査される複数本の表示電極を駆動するドライバ回路に接続する２本の電源ライン対の各々に、２個のトランジスタで構成されたプッシュプル型のドライバ回路を設けると共に、個々のドライバ回路に接続する一方の電源ラインに所定の電圧を印加する電源回路手段及び電源ラインに印加された所定の電荷をリークさせるリーク制御スイッチ手段を設けることにより、耐圧が低く、高速順次走査が可能であり、電荷回収ができるものであった。

【０００５】

【発明が解決しようとする課題】しかしながら、このような上述した従来の第１～第４の技術に示された回路では、出力ドライバの導通をトリガするために使われるインダクタの電荷回収側の“フライバック”遷移を発生させることとなる。また、維持ドライバを制御するためのフライバック電流は、出力ドライバが導通しつつある間に、パネルから電流を引き出すという副作用を発生させることとなる。この副作用のためにリンギング電流を発生する。つまり、共振サイクルの終わりにインダクタの回収側に電圧フライバックが発生することとなる。インダクタ電圧は最初に印加された強制電圧と逆向きである。フライバック電流は、パネル電圧と一致させるためにインダクタの回収側の容量を充電または放電するために流れる。その動作中、要望される遷移と逆の方向に電荷が転送され、その結果、回路によって浪費される回収できない電荷の増加と、出力ドライバが導通するときにノイズが発生するという課題があった。

【０００６】本発明は上記課題を解決するものであり、そのためにコイルを流れる電流を検知し、その電流の値によってスイッチ手段の制御をするスイッチ制御手段を有する構成となっており、以下の動作をするものである。かかるスイッチ制御手段は、例えば、二次巻線を有し、当該二次巻線はコイルにかかる瞬間電圧に比例した電圧を生じる。電流がコイルを通ってパネル容量に流れ込むと、パネル電圧が駆動電圧と等しくなる時にコイルにかかる電圧はゼロに減少する。コイルに蓄積されたエネルギは、パネル容量をさらに充電するために電流が流れ続けるようにする。パネル電圧が駆動電圧を越して上昇すると、コイルの電圧の極性は逆転し、パネル電圧とともに増加する。この極性の変化と、電圧上昇は２次巻線に引き継がれ、各々の出力ドライバを導通させるのに使われる。出力ドライバの導通はゲート抵抗により制限される。これは、コイルがそれに留まっているエネルギをパネルに転送しながら、MOSFETの容量がそのMOSFETを通って流れる電流を制限する。極性変化は、出力ドライバが導通できる前に生じるに違いないので、コイルにより転送されたエネルギの総量は、変動容量性負荷のもとでさえいつも最大化されている。出力ドライバがゆっくりと導通し、フライバックが起こるときには十分に導通

しているため、ＥＭＩ効果は減少させられる。これは、従来の技術において現れるリンギング電流を除去する。

【０００７】このことにより、正確に制御できる電荷回収を可能にし、誘導的に発生したフライバック電流がパネルの画素位置に不利に影響を及ぼすことを防止することを目的としたものである。

【０００８】

【課題を解決するための手段】上記課題を解決するため本発明の技術的手段は、走査電極に走査電圧と放電維持電圧を選択的に結合する切換手段と、切換手段を介して全走査電極に第２の端子が接続されるインダクタ手段と、駆動電圧を供給する駆動電圧源手段と、駆動電圧より大きな電圧値を示す放電維持電圧を供給する電圧供給手段と、インダクタ手段の第２の端子と電圧供給手段を選択的に結合する第２のスイッチ手段と、インダクタ手段の第１の端子と駆動電圧源手段を入力信号の変化に応じて選択的に結合する第１のスイッチ手段と、インダクタ手段に流れる電流の大きさに応答するスイッチ制御手段とを具備し、切換手段が、放電維持電圧を前記走査電極に結合するよう選択している状況において、充電状態の間、第１のスイッチ手段は、入力信号が第１の変化をすると駆動電圧源手段をインダクタ手段の第１の端子に結合し、インダクタ手段を通して走査電極の容量を充電する第１の電流が生じ、インダクタ手段は走査電極が駆動電圧を超える電圧に達することを引き起こし、やがて第１の電流はゼロに向かって減少し、スイッチ制御手段は、少なくとも第１の電流がゼロに戻る少し前までは第２のスイッチ手段を開状態にし、インダクタ手段に流れる電流の大きさに応答して、第２のスイッチ手段を第１の電流の流れがゼロに達する前記少し前からゆっくり導通させ始め、ゼロに達するときには完全に導通状態にして第２のスイッチ手段を閉じ、電圧供給手段は、それにつづく放電維持状態の間、走査電極への放電電流とインダクタ手段へのフライバック電流の両方を供給するものである。

【０００９】また、本発明は、インダクタ手段の第１の端子と駆動電圧源手段を入力信号の第２の変化に応じて選択的に結合する第３のスイッチ手段と、インダクタ手段の第２の端子と共通電位源を選択的に結合する第４のスイッチ手段とをさらに具備し、第３のスイッチ手段は、入力信号が第２の変化をすると駆動電圧源手段をインダクタ手段の第１の端子に結合し、インダクタ手段を通して走査電極の容量を放電する第２の電流が生じ、インダクタ手段は走査電極が駆動電圧を下回る電圧に達することを引き起こし、やがて第２の電流はゼロに向かって減少し、スイッチ制御手段は、少なくとも第２の電流がゼロに戻る少し前までは第４のスイッチ手段を開状態にし、インダクタ手段に流れる電流の大きさに応答して、第４のスイッチ手段を第２の電流の流れがゼロに達する前記少し前からゆっくり導通させ始め、ゼロに達するときには完全に導通状態にして第４のスイッチ手段を閉じ、共通電位源は、インダクタ手段からのフライバック電流を流入するとともに、パネル容量に対して放電路となるものである。

【００１０】また、本発明は、データ電極のそれぞれをインダクタ手段の第２の端子と選択的に結合しデータ電極を駆動するデータ電極駆動手段と、駆動電圧を供給する駆動電圧源手段と、駆動電圧より大きな電圧値を示すデータ電圧を供給する電圧供給手段と、インダクタ手段の第１の端子と駆動電圧源手段を入力信号の第３の変化に応じて選択的に結合する第１のスイッチ手段と、インダクタ手段に流れる電流の大きさに応答するスイッチ制御手段とを具備し、データ電極駆動手段は、放電させるべきデータ電極とインダクタ手段の第２の端子を選択的に結合する第５のスイッチ手段と、第５のスイッチ手段によりインダクタ手段の第２の端子と結合されているデータ電極と電圧供給手段とを選択的に導通させる第２のスイッチ手段を有し、第１のスイッチ手段は、入力信号が変化すると駆動電圧源手段を前記インダクタ手段の第１の端子に結合し、インダクタ手段を通して第５のスイッチ手段により結合されているデータ電極の容量を充電する第１の電流が生じ、インダクタ手段はデータ電極が駆動電圧を超える電圧に達することを引き起こし、やがて第１の電流はゼロに向かって減少し、スイッチ制御手段は、少なくとも第１の電流がゼロに戻る少し前までは第２のスイッチ手段を開状態にし、インダクタ手段に流れる電流の大きさに応答して、第２のスイッチ手段を第１の電流の流れがゼロに達する前記少し前からゆっくり導通させ始め、ゼロに達するときには完全に導通状態にして第２のスイッチ手段を閉じ、電圧供給手段は、それにつづく電圧維持状態の間、データ電極への放電電流と前記インダクタ手段へのフライバック電流の両方を供給するものである。

【００１１】さらに、インダクタ手段の第１の端子と駆動電圧源手段を入力信号の第４の変化に応じて選択的に結合する第３のスイッチ手段と、データ電極駆動手段に、第５のスイッチ手段によりインダクタ手段の第２の端子と結合されている前記データ電極と共通電位源とを選択的に導通させる第４のスイッチ手段をさらに具備し、第３のスイッチ手段は、入力信号が第４の変化をすると駆動電圧源手段をインダクタ手段の第１の端子に結合し、インダクタ手段を通して走査電極の容量を放電する第２の電流が生じ、インダクタ手段は走査電極が駆動電圧を下回る電圧に達することを引き起こし、やがて第２の電流はゼロに向かって減少し、スイッチ制御手段は、少なくとも第２の電流がゼロに戻る少し前までは第４のスイッチ手段を開状態にし、インダクタ手段に流れる電流の大きさに応答して、第４のスイッチ手段を第２の電流の流れがゼロに達する前記少し前からゆっくり導通させ始め、ゼロに達するときには完全に導通状態にし

て第４のスイッチ手段を閉じ、共通電位源は、前記インダクタ手段からのフライバック電流を流入するとともに、データ電極容量に対して放電路となるものである。

【００１２】

【発明の実施の形態】上記課題を解決するために、本発明は、プラズマディスプレイ駆動回路にコイルを流れる電流を検知し、その電流の値によってスイッチ手段の制御をするスイッチ制御手段を付加したものおよび当該プラズマディスプレイ駆動回路を具備したプラズマディスプレイ装置およびその装置を用いたテレビジョン装置およびコンピュータ装置に関するものであり、前記スイッチ制御手段によりコイルを流れる電流がゼロに達する少し前から対応するスイッチ手段をゆっくり導通させ始め、ゼロに達するときには完全に当該スイッチ手段を導通状態にする制御をすることにより、フライバックが起こるときには十分に導通しているため、ＥＭＩ効果は減少させることができる。

【００１３】このことにより、正確に制御できる電荷回収を可能にし、そして誘導的に発生したフライバック電流がパネルの画素位置に不利に影響を及ぼすことを防止できるものある。

【００１４】

【実施例】以下、本発明の実施例について、添付図面に基づいて説明する。

（実施例１）図１は、実施例１のＸドライバ１１及びＹドライバ１２の要部回路構成を示す。 Ｘドライバ１１は、維持電極Ｘに対するものであり、電荷回収／再利用のための回収用コンデンサ１１１、双方向スイッチ１１２、コイル１１３、維持パルス補助出力用のスイッチ手段１１４、全面書込みパルス出力用のスイッチ手段１１５、スイッチ制御手段１１６とを備えている。スイッチ制御手段１１６は、コイル１１３を流れる電流がゼロになる時点を検知し、ゼロになる少し手前でスイッチ手段１１４Ａ、１１４Ｂを切り替える制御をする。また、双方向スイッチ手段１１２には、２つのスイッチ手段１１２Ａ，１１２Ｂがあり、それらは並列接続された構成となっている。また、維持パルス補助出力用のスイッチ手段１１４にも２つのスイッチ手段１１４Ａ，１１４Ｂがある。

【００１５】回収用コンデンサ１１１は、その一端がグランド線に接続され、他端が双方向スイッチ手段１１２及びコイル１１３を介して維持電極Ｘに接続されている。また、維持電極Ｘはスイッチ手段１１４Ａを介して維持電圧供給線Ｖｓに接続され、スイッチ手段１１４Ｂを介してグランド線に接続され、スイッチ手段１１５を介して書き込み電圧供給線Ｖｗに接続されている。

【００１６】双方向スイッチ手段１１２とスイッチ手段１１４の具体的構成例については、特開平５－２６５３９７号公報に説明されている。Ｙドライバ１２は、走査電極Ｙ１～Ｙｎに対するものであり、表示データ書込みパルス及び維持パルス出力用の半導体集積回路１２１と、半導体集積回路１２１の外部に電力回収／再利用のための回収用コンデンサ１２２、スイッチ手段１２３Ａ，スイッチ手段１２３Ｂ、コイル１２４Ａ，１２４Ｂ，スイッチ手段１２５Ａ、スイッチ手段１２５Ｂ、およびコイル１２４Ａ、１２４Ｂに結合され電流の流れに応答するスイッチ制御手段１２６Ａ，１２６Ｂを備えている。

【００１７】回収用コンデンサ１２２は、その一端がグランド線に接続され、他端が、一方ではスイッチ手段１２３Ａ、コイル１２４Ａ及びスイッチ手段１２５Ａを介して維持電圧供給線Ｖｓに接続され、他方ではスイッチ手段１２３Ｂ，コイル１２４Ｂ及びスイッチ手段１２５Ｂを介してグランド線に接続されている。スイッチ手段１２３Ａは、結合中は、コイル１２４Ａを通して走査電極のパネル容量を充電する電流が生じ、コイル１２４Ａはパネル端子が駆動電圧を超える電圧に達することを引き起こし、そのポイントでは電流は０に達する。

【００１８】また、スイッチ制御手段１２６Ａは、走査電極Ｙ１～Ｙｎに電荷を充電状態の間はスイッチ手段１２５Ａが開状態になるよう動作し、その後はコイル１２４Ａから導出される信号に応答して、スイッチ手段１２５Ａをコイル１２４Ａの電流の流れが０に達する少し前あたりで完全に導通状態にせしめるために、ゆっくりとスイッチ手段１２５Ａを閉じるよう動作する。維持電圧供給線Ｖｓは、次の状態の間、パネル端子への電流とコイル１２４Ａへのフライバック電流の両方を供給する。さらに、スイッチ制御手段１２６Ｂは、走査電極Ｙ１～Ｙｎの電荷の放電維持状態の間はスイッチ手段１２５Ｂが開状態になるよう動作し、その後はコイル１２４Ｂから導出される信号に応答して、スイッチ手段１２５Ｂをコイル１２４Ｂの電流の流れが０に達する少し前あたりで完全に導通状態にせしめるために、ゆっくりとスイッチ手段１２５Ｂを閉じるよう動作する。

【００１９】コイル１２４Ａとスイッチ手段１２５Ａの接続点は、スイッチ手段１２６１Ａ～１２６ｎＡに共通に接続され、コイル１２４Ｂとスイッチ手段１２５Ｂの接続点は、スイッチ手段１２６１Ｂ～１２６ｎＢに接続され、走査電極Ｙｉに接続され、かつ、スイッチ手段３４ｉＡとスイッチ手段３４ｉＢの接続部に接続されている。なお、スイッチ手段１２６１Ａ～１２６ｎＡ、１２６１Ｂ～１２６ｎＢは、走査電極に走査電圧と放電維持電圧を選択的に結合する切換手段として機能する。

【００２０】なお、回収用コンデンサ１１１及び１２２は共に、維持電極Ｘと走査電極Ｙ１～Ｙｎとの間の全容量ＣＰよりも相当大きく、例えばＣＰの１００倍以上である１０μＦであって、電荷回収／再利用の際には殆ど電圧変動がないようにしている。以下の説明では、回収用コンデンサ１１１及び１２２の端子間電圧は共に、Ｖｓ／２になっている。

【００２１】次に、上記の如く構成された本実施例の動作の一例を、図２に示す電圧波形が維持電極Ｘ及び走査電極Ｙ１～Ｙｎに印加される場合について説明する。

Ｗ）全面書込み期間

最初、スイッチ手段１１２Ａ、１１２Ｂ、１１４Ａ、１１４Ｂ、１１５、１２３Ａ、１２３Ｂ，１２５Ａ、１２５Ｂ，１２６１Ａ～１２６ｎＡ及び１２６１Ｂ～１２６ｎＢが共にオフ、維持電極Ｘ及び走査電極Ｙ１～Ｙｎが共に維持電圧Ｖｓになっているとする。

【００２２】（１）この状態でスイッチ手段１２３Ｂ、１２６１Ａ～１２６ｎＢをオンにすると、走査電極Ｙ１～Ｙｎからコイル１２４Ｂ及びスイッチ手段１２３Ｂを通って回収用コンデンサ１２２に電荷が回収される。コイル１２４Ｂのインダクタンス作用により、走査電極Ｙ１～Ｙｎの電圧がＶｓ／２となっても電流が流れ続け、走査電極Ｙ１～Ｙｎの電圧がＧＮＤレベルに向かう。しかし、この電流経路の抵抗成分の電力消費により、走査電極Ｙ１～Ｙｎの電圧がＧＮＤレベルまで低下しきらない。そこで、このときスイッチ制御手段１２６Ｂがコイル１２４Ｂを流れる電流が０になることを検知して、０になる少し手前で、スイッチ手段１２５Ｂをゆっくり導通して、走査電極Ｙ１～Ｙｎの残った電荷を、スイッチ手段１２５Ｂを通ってグランド線側に放電させる。このとき、スイッチ手段１２３Ｂ及びコイル１２４Ｂの端子間電圧が０に収束する。そして、走査電極Ｙ１がＧＮＤレベルになったと考えられる時点で、スイッチ手段１２３Ｂ及びスイッチ手段１２５Ｂを共にオフにする。なお、スイッチ手段１２３Ｂとスイッチ手段１２５Ｂをオフにする時点とは同時でなくても良い。

【００２３】（２）（１）の制御時に、スイッチ手段１１５をオンにして維持電極Ｘの電圧を書込み電圧Ｖｗまで上昇させた後、スイッチ手段１１５をオフにする。これにより、維持電極Ｘが維持電極Ｖｓから書込み電圧Ｖｗまで急に立ち上がり、維持電極Ｘと走査電極Ｙ１～Ｙｎとの間で書込み放電が生ずる。

（３）次に、スイッチ手段１１２Ｂ及びスイッチ手段１２３Ａを同時にオンにする。これにより、維持電極Ｘ上の電荷がコイル１１３及びスイッチ手段１１２Ｂを通って回収用コンデンサ１１１に回収され、同時に回収用コンデンサ１２２の回収電荷がスイッチ手段１２３Ａ、コイル１２４Ａ及びダイオード１２６１Ｂ～１２６ｎＢを通って走査電極Ｙ１～Ｙｎに充電される。

【００２４】そして、スイッチ手段１２３Ｂを閉じる。また、スイッチ制御手段１２６Ａはコイル１２４Ａを流れる電流が０になることを検知して、電流の流れが０に達する時点あたりでスイッチ手段１２５Ａを閉じるよう動作し、フライバック電流が発生した場合にも、ＥＭＩ効果は減少させることができる。また、スイッチ手段１１４Ｂをオンにして、電流経路の抵抗成分の電力消費により回収しきれない維持電極Ｘ上に残った電荷をグランド線側に放電させ、これと同時に（維持放電発生前に）、スイッチ手段１２５Ａをオンにして、コイル１２４Ａの端子間電圧が０（各端子の電位がＶｓ）に収束する。維持電極ＸがＧＮＤレベルになり走査電極Ｙ１～Ｙｎが維持電圧Ｖｓになったと考えられる時点で、スイッチ手段１１２Ｂ、スイッチ手段１１４Ｂ、スイッチ手段１２３Ａ及びスイッチ手段１２５Ａを共にオフにする。なお、スイッチ手段１２３Ａをオフにする時点とスイッチ手段１２５Ａをオフにする時点とは同時でなくても良い（以下同様）。

【００２５】（４）次に、スイッチ手段１１２Ａをオンにする。これにより、回収用コンデンサ１１１の電荷がスイッチ手段１１２Ａ及びコイル１１３を通って維持電極Ｘに充電される。このとき、スイッチ制御手段１１６がコイル１１３を流れる電流が０になることを検知して、０になる少し手前でスイッチ手段１１４Ａをゆっくり導通して、維持電圧供給線Ｖｓからスイッチ手段１１４Ａを通って維持電極Ｘに電荷を補給する。そして、維持電極Ｘが維持電圧Ｖｓになったと考えられる時点で、スイッチ手段１１２Ａ及びスイッチ手段１１４Ａを共にオフにする。

【００２６】Ａ）アドレス期間

この期間ではＸドライバ１１を使用せず、維持電極Ｘは維持電圧Ｖｓに保たれている。また、Ｙドライバ１２側の電荷回収／再利用回路も使用しない。この期間での無駄な電力消費は、比較的少ない。

（５）スイッチ手段３４１Ｂのみをオンにして走査電極Ｙ１の電圧をＧＮＤレベルにした後、スイッチ手段３４１Ｂをオフにする。この状態で、例えば、特開平５－２６５３９７の図５に記載されているようなアドレスドライバにより第１表示行に表示データの書込みが行われる。すなわち、第１表示行の消灯しようとするセルに対応したアドレス電極と走査電極Ｙ１との間で自己消去放電が行われる。次に、スイッチ手段３４１Ａのみをオンにして走査電極Ｙ１の電圧を維持電圧Ｖｓに戻した後、スイッチ手段３４１Ａをオフにする。

【００２７】以下、第２～ｎ表示行についてこの順に、同様の動作が行われる。

Ｓ）維持放電期間

（６）次に、スイッチ手段１１２Ｂをオンにする。これにより、維持電極Ｘ上の電荷がコイル１１３及びスイッチ手段１１２Ｂを通って回収用コンデンサ１１１に回収される。このとき、スイッチ制御手段１１６はコイル１１３を流れる電流を検知し、当該電流が０になる少し手前でスイッチ手段１１４Ｂをゆっくり導通して、回収しきれない維持電極Ｘ上に残った電荷をグランド線側に放電させ、維持電極ＸがＧＮＤレベルになったと考えられる時点で、スイッチ手段１１２Ｂ及びスイッチ手段１１４Ｂを共にオフにする。

【００２８】（７）次に、スイッチ手段１１２Ａをオン

にする。これにより、回収用コンデンサ１１１の回収電荷がスイッチ手段１１２Ａ及びコイル１１３を通って維持電極Ｘに充電される。このとき、スイッチ制御手段１１６はコイル１１３を流れる電流を検知し、当該電流が０になる少し手前でスイッチ手段１１４Ａをゆっくり導通して、維持電圧Ｖｓからスイッチ手段１１４Ａを通って維持電極Ｘに電荷を補給する。そして、維持電極Ｘが維持電圧Ｖｓになったと考えられる時点で、スイッチ手段１１２Ａ及びスイッチ手段１１４Ａを共にオフにする。

【００２９】（８）次に、スイッチ手段１２３Ｂ、１２６１Ｂ～１２６ｎＢをオンにする。これにより走査電極Ｙ１～Ｙｎからコイル１２４Ｂ及びスイッチ手段１２３Ｂを通って回収用コンデンサ１２２に電荷が回収される。その間に、スイッチ制御手段１２６Ｂはコイル１２４Ｂを流れる電流が０になることを検知して、電流の流れが０に達する時点あたりでスイッチ手段１２５Ｂをゆっくり閉じるよう動作し、フライバック電流が発生した場合にも、ＥＭＩ効果は減少させることができる。次に、スイッチ手段１２５Ｂをオンにしたまま、走査電極Ｙ１～Ｙｎ上に残った電荷を、スイッチ手段１２５Ｂを通ってグランド線側に放電させる。そして、走査電極Ｙ１がＧＮＤレベルになったと考えられる時点で、スイッチ手段１２３Ｂ及びスイッチ手段１２５Ｂをオフにする。

【００３０】（９）次に、スイッチ手段１２３Ａをオンにする。これにより、回収用コンデンサ１２２の回収電荷がスイッチ手段１２３Ａ、コイル１２４Ａ及びダイオード１２６１Ａ～１２６ｎＡを通って走査電極Ｙ１～Ｙｎに充電される。この時に、スイッチ制御手段１２６Ａはコイル１２４Ａを流れる電流が０になることを検知して、電流の流れが０に達する少し前あたりでスイッチ手段１２５Ａ及びスイッチ手段１２３Ｂをゆっくり導通し、フライバック電流が発生した場合にも、ＥＭＩ効果は減少させることができる。

【００３１】そして、維持放電供給線Ｖｓからオンにしたスイッチ手段１２５Ａ及びダイオード１２６１Ａ～１２６ｎＡを通って走査電極Ｙ１～Ｙｎに電荷を補給する。そして、走査電極Ｙ１～Ｙｎが維持電圧Ｖｓになったと考えられる時点で、スイッチ手段１２３Ａ及びスイッチ手段１２５Ａを共にオフにする。以下、上記（６）～（９）の動作が繰り返される。

【００３２】なお、上述したスイッチ手段１１４Ａ、１１４Ｂ、１２５Ａ、１２５Ｂをゆっくり導通するタイミングは、出力電圧が上昇時には最大レベルの１／２以上になった時点以降、または出力電圧が下降時には最小レベルの１／２以下になった時点以降とする。なぜなら、出力電圧が上昇時に最大レベルの１／２以下の段階でスイッチ手段を導通させると、不具合の状態によっては対応するスイッチ手段（例えば、スイッチ手段１１４Ａに対してスイッチ手段１１４Ｂ）も同時にオンになることもあり、危険だからである。また、かかる場合には、電力効率も良くないからである。

【００３３】以上より、本実施例において、簡単な構成でＸドライバ１１のみならずＹドライバ１２においても充放電に関する電荷を回収し再利用できる回路において、フライバック電流の発生を押さえられ、またフライバック電流が発生した場合にも、ＥＭＩ効果は減少させられる。すなわち、リンギング電流を除去できる。なお、本実施例における駆動回路はパネルと一体に構成され、パネル表示装置である図１０に示すようなプラズマディスプレイに利用できる。さらに、そのパネル表示装置は放送受信部を備えるテレビジョン装置に利用しても良い。テレビジョン装置に利用することにより、ノイズの発生が押さえられ、画面のちらつきなどを低減することができる。なお、図１１に放送受信部を備えたテレビジョン装置を示す。また、パネル表示装置はキーボードやマウスなどの入力操作装置とＣＰＵなどからなる演算処理装置を有するコンピュータ装置に利用しても良い。コンピュータ装置に当該プラズマディスプレイを用いることにより、ノイズを低減でき、誤動作が発生する可能性が少なくなるという効果が生ずる。コンピュータ装置の例を図１２に示す。

【００３４】また、スイッチ手段１２６１Ａ～１２６ｎＡ、１２６１Ｂ～１２６ｎＢは、図１３に示すようなダイオードでも良いし、特公平７－１０９５４２号公報の第１図ａ，ｂ，ｃに示されたようないずれのスイッチ手段でも良い。

（実施例２）次に、本発明の実施例２について図３を参照して説明する。

【００３５】図３は、実施例２の具体的回路構成を示す図で、無効電力回収回路３１とドライバーＩＣの１つの出力回路３２からなる。無効電力回収回路３１は、回収用コンデンサ３１０１と並列接続されたスイッチ手段３１０２及びスイッチ手段３１０３とコイル３１０４と高電位側電源３１０５と低電位側電源３１０６とコイル３１０４の一端と高電位側電源３１０５を接続するスイッチ手段３１０７とコイル３１０４の一端と低電位側電源３１０６を接続するスイッチ手段３１０８とスイッチ制御手段３１０９と回収用コンデンサ３１０１の一端と接続される低電位側電源３１１０とからなり、無効電力回収回路の出力３１１１を通じてドライバーＩＣの１つの出力回路３２と繋がっている。また、ドライバーＩＣの１つの出力回路３２は入力端子３２０１とスイッチ手段３２０２、３２０３とドライバーＩＣの高電位側電源端子３２０４と低電位側電源端子３２０５とからなり、ドライバーＩＣの１つの出力回路３２は出力端子３３から負荷容量３４に接続されている。なお、スイッチ制御手段３１０９は、コイル３１０４を流れる電流を検知し、その電流によって各スイッチ手段を制御するものであ

る。

【００３６】この回路構成において、入力端子３２０１を制御して、スイッチ手段３２０２をオンにすると、無効電力回収回路３１で作られた出力パルスが、ＸＹマトリクスパネルの電極に印加される。パネルの電極にはキャパシタンスが存在するが、無効電力回収回路３１によって充放電に伴う電力は回収される。スイッチ手段３２０３をオンにすると、出力はロウに固定することができる。そして、回収用コンデンサ３１０１に電荷を回収しているときに、スイッチ制御手段３１０９はコイル３１０４を流れる電流を検知することとし、その電流が０になったことを検知して、電流の流れが０に達する少し前あたりでスイッチ手段３１０５をゆっくり導通する。かかる制御をすることで、フライバック電流が発生した場合にもＥＭＩ効果は減少させることができる。

【００３７】なお、上述したスイッチ手段３１０７、３１０８をゆっくり導通するタイミングは、実施例１で説明した駆動回路の動作と同様で、出力電圧が上昇時には最大レベルの１／２以上になった時点以降、または出力電圧が下降時には最小レベルの１／２以下になった時点以降とする。なぜなら、出力電圧が上昇時に最大レベルの１／２以下の段階でスイッチ手段を導通させると、不具合の状態によっては対応するスイッチ手段（例えば、スイッチ手段３１０７に対してスイッチ手段３１０８）も同時にオンになることもあり、危険だからである。また、かかる場合には、電力効率も良くないからである。

【００３８】以上、本実施例によれば、電荷回収可能な回路において、フライバック電流が発生した場合にも、ＥＭＩ効果は減少させることができる。なお、本実施例における駆動回路はパネルと一体に構成され、パネル表示装置である図１０に示すようなプラズマディスプレイに利用できる。さらに、そのパネル表示装置は放送受信部を備えるテレビジョン装置に利用しても良い。テレビジョン装置に利用することにより、ノイズの発生が押さえられ、画面のちらつきなどを低減することができる。なお、図１１に放送受信部を備えたテレビジョン装置を示す。また、パネル表示装置はキーボードやマウスなどの入力操作装置とＣＰＵなどからなる演算処理装置を有するコンピュータ装置に利用しても良い。コンピュータ装置に当該プラズマディスプレイを用いることにより、ノイズを低減でき、誤動作が発生する可能性が少なくなるという効果が生ずる。コンピュータ装置の例を図１２に示す。

【００３９】（実施例３）次に、本発明の実施例３について図４および図５を参照して説明する。図４は、実施例３のプラズマディスプレイの駆動回路を示す。図４に示す駆動回路は、当該電極４０１、４０２に印加される適宜の電圧に従って、所定量の電荷を蓄積しうるメモリー機能と放電発光機能とを有しているプラズマディスプレイであって、且つ該ディスプレイに表示される一連の表示動作の期間が、当該複数個のセル部を選択して適宜の表示データの書き込み操作を実行する為、複数本の表示ラインを線順次にて選択する走査を行うセル部に表示データを書き込む期間、例えばアドレス期間Ｓ－１と該アドレス期間Ｓ－１に於いて、該表示データが書き込まれたセル部を所定の期間、複数回放電発光させる期間、例えば維持放電期間Ｓ－２とで構成せしめる様に構成されているディスプレイにおいて、該走査される複数本の表示ラインを構成する一方の電極、例えばＹ電極４０２を駆動させるドライバ回路に接続する２本の電源ラインＦＶＨ，ＦＬＧの各々に、２個のスイッチ手段４０３、４０４で構成されたドライバ回路４００を並列に設けると共に、当該ドライバ回路に接続する個々の電源ラインの少なくとも一方に所定の電圧、即ち、第１の電源ライン、を印加する電源回路手段４１０、該ドライバ回路に接続する個々の電源ラインに印加された所定の電圧をリークさせるスイッチ手段４２０、少なくとも第１の状態の間はスイッチ手段４０３が開状態になるよう動作し、その後はコイル４０５から導出される信号に応答して、コイル４０５の電流の流れが０に達する少し前あたりで完全に導通状態にせしめるためにスイッチ手段４１３をゆっくり閉じるよう動作するスイッチ制御手段４０６とが設けられている。

【００４０】本発明に係る該プラズマディスプレイは、例えば、Ｘ電極４０１、Ｙ電極４０２、及び図示しないアドレス電極からなる３電極を使用して画像の表示駆動を実行するものである。つまり、本発明に係るプラズマディスプレイの駆動回路において、当該走査電極４０２に対して走査を実行する為に必要なＯＮ電圧（例えばＧＮＤ）及びＯＦＦ電圧（例えばＶｓｃ）をドライバ回路に接続する一方の電源ライン（第１の電源ライン）に与えるドライバ回路で構成されたＹ電極スキャンドライバ回路群４１０１、４１０２・・・４１０ｎと、該スキャンドライバ回路群４１０１、４１０２・・・４１０ｎに共通の電源ラインに走査用電圧である、該第１の電源手段の電圧（例えば走査時にＯＦＦの電圧でＶｓｃ）を供給したり、遮断したりする為に設置された電源回路手段４１０と、該スキャンドライバ回路群４１０１、４１０２・・・４１０ｎのそれぞれの電源ラインに印加された該走査用の電圧をリークさせて、該電源ラインの電圧を０Ｖ、若しくはＧＮＤにするためのスイッチ手段４２０が設けられているものである。

【００４１】さらに、本実施例における電源回路手段４１０は、セル部に表示データを書き込む期間である走査アドレス期間Ｓ－１において、当該ドライバ回路に接続する２本の電源ラインＦＶＨ及びＦＬＧの内の少なくとも一方、例えばＦＶＨ１～ＦＶＨｎ（第１の電源ライン）に所定の電圧例えばＶｓｃを印加させる第１の電源手段４１０Ａと、表示データが書き込まれたセル部を所定の期間放電させるための期間である維持放電期間Ｓ－

２において当該ＦＶＨ１～ＦＶＨｎに所定の電圧を印加させる第２の電源手段４１０Ｂとで構成されている、とする。

【００４２】更に、本発明において使用される該第１の電源手段４１０Ａは、高電圧電源、例えばＶｓｃを発生する第１の電圧発生手段４１１と低電圧電源、例えばＧＮＤ、を発生する第２の電圧発生手段４１２とから構成されたものであって、該第１の電源発生手段４１１は、前記ドライバ回路に接続する２本の電源ライン（ＦＶＨ，ＦＬＧ）のうちの一方の電源ライン例えば、配線ＦＶＨ（第１の電源ライン）に接続され、該第２の電圧発生手段４１２は、前記ドライバ回路に接続する２本の電源ライン（ＦＶＨ，ＦＬＧ）のうちの他方の電源ライン例えば、配線ＦＬＧ（第２の電源ライン）に接続されている、とする。

【００４３】本発明において使用される、前記した各電源手段４１１、４１２にはそれぞれスイッチ手段４１３、４１４が設けられており、外部から入力される所定の制御信号により所定の電圧をドライバ回路に接続する２本の電源ライン（ＦＶＨ１～ＦＶＨｎ及びＦＬＧ１～ＦＬＧｎ）の何れかの配線（例えばＦＶＨ１～ＦＶＨｎ）に供給する様に構成されている、とする。

【００４４】更に、上記のスイッチ手段４１３、４１４はＭＯＳＦＥＴで構成されている、とする。更に、本発明に係るディスプレイの駆動回路における第１の電源手段４１０Ａの、該第１の電圧発生手段４１１と該ドライバ回路に接続する２本の電源ラインのうちの一方の配線例えばＦＶＨ（第１の電源ライン）との間に、ダイオード若しくは抵抗もしくは、その両方が接続されている、とする。

【００４５】一方、本発明におけるディスプレイの駆動装置において使用される電源回路４１０を構成する、該第２の電源手段４１０Ｂは、２個の異なる電位を発生する電圧発生手段４１５、４１６から構成されており、各電圧発生手段４１５、４１６は、ドライバ回路に接続する電源ライン表示ライン（ＦＶＨ，ＦＬＧ）のそれぞれに個別に接続されている、とする。

【００４６】本具体例においては、ＧＮＤ電位を供給する第１の電圧発生手段４１５が、ドライバ回路に接続する２本の電源ラインの内、例えば電源ラインＦＶＨに接続されており、また、高電圧であるＶｓを供給する第２の電圧発生手段４１６が、該ドライバ回路に接続する２本の電源ラインの内、他の電源ラインＦＬＧ（第２の電源ライン）に接続されているものである。

【００４７】更に、本発明における前記した第２の電源回路４１０Ｂを構成する電圧発生手段４１５、４１６にはそれぞれスイッチ手段４１７、４１８が設けられおり、外部から入力され所定の制御信号により所定の電圧を該ドライバ回路に接続する電源ライン（例えばＦＶＨ或いはＦＬＧ）の何れかに供給する様に構成されている、とする。

【００４８】更に、上記のスイッチ手段４１７、４１８は、ＭＯＳＦＥＴで構成されている、とする。なお、上記した該第２の電源手段４１０Ｂにおける各電圧発生手段４１５、４１６に設けられているスイッチ手段４１７、４１８である当該ＭＯＳＦＥＴには、ダイオードＤ４１０Ａ、Ｄ４１０Ｂがそれぞれ並列に接続されていても良い。一方、本発明に係るディスプレイの駆動回路において、Ｙ電極側の走査ドライバ回路の各スイッチ手段４１３、４１４にはダイオードＤ４０７、Ｄ４０８がそれぞれ並列に接続されている、とする。

【００４９】又、本発明において使用されている各Ｙ電極側のドライバ回路に接続する電源ラインは、２本の電源ライン間（ＦＶＨ，ＦＬＧ）で構成され、当該ドライバ回路４１０１が、該２本の電源ライン（ＦＶＨ，ＦＬＧ）に並列に接続挿入されているものである。なお、前記した様に、該ディスプレイにおける他方の電極、即ちＸ電極は、共通電極である。

【００５０】また、本発明において使用される前記リーク制御スイッチ手段４２０は、例えば、ＭＯＳＦＥＴで構成されているスイッチ手段４２１を有しているものであっても良く、前記第１の電圧発生手段４１１が接続されている側の電源ライン（ＦＶＨ）に接続されているものである。次に、本発明に係るディスプレイにおいては、該ドライバ回路に接続する２本の電源ラインを構成する各電源ライン（ＦＶＨ，ＦＬＧ）のそれぞれには電荷回収回路４５０が接続されている、とする。

【００５１】当該電荷回収回路４５０は、例えば、ディスプレイパネルの持つ容量とダイオードＤ４０７及びＤ４０８を介したコイル４０５、４５１とによる直列共振回路で構成されている、とする。本発明において、当該２系列に構成された該パネル容量とダイオードを介したコイルとによる直列共振回路４５０における各コイル４０５、４５１のインダクタンス値が互いに異なる様に設定することも可能である。

【００５２】つまり、本発明に係る該電荷回収回路４５０は、これに接続されるダイオード、或いはＭＯＳＦＥＴ等で構成される２系統のＬ－Ｃ共振経路を持つものであり、かかる電荷回収路は、その共振時に発生するピーク電圧から、所定の電圧（Ｖｓ或いはＧＮＤ）へクランプすることが可能であり、その一部の電荷を、後記するコンデンサに蓄えておき、次ぎの走査期間にその電荷を利用するものである。

【００５３】前記した、第２の電源回路４１０Ｂは、表示発光を繰り返す維持放電期間の際の電流を供給する為のスイッチ機能を有するものである。なお、該電荷回収回路４５０の詳細な回路構成は、特に限定されるものではなく、従来公知の電荷回収回路を使用することが可能であるが、図１の具体例においては、コイル４０５、４５１の他に、ダイオードＤ４５１、Ｄ４５２、Ｄ４５

３、Ｄ４５４、Ｄ４５５、Ｄ４５６、Ｄ４５７、Ｄ４５８、及びスイッチ４５２、４５３更にはコンデンサ４５４とが図示の様な配列で構成されたものを使用している。

【００５４】上記した本発明に係るディスプレイの駆動回路においては、上記した構成を前提として、適宜の駆動操作を行うものであるが、その駆動方法の基本的な構成は、前記した構成を有するディスプレイにおいて、該セルを構成し、放電を行う一対の電極のうち、一方の電極の各々に、２個のトランジスタで構成されたドライバ回路を設けると共に、前記セル部に表示データを書き込む期間において、当該個々の電極に所定の電圧を印加させる第１の電源手段と、該表示データが書き込まれた該セル部を所定の期間放電させるための期間において当該個々の電極に所定の電圧を印加させる第２の電源手段と、該個々の電極に印加された所定の電圧をリークさせるリーク制御スイッチ手段とが設けられているディスプレイにおいて、該セル部に表示データを書き込む直前に、当該第１の電源手段を作動させて、当該電極に所定の電圧を印加さしめる工程、該セル部に表示データを書き込む期間の終了直前に、第１の電源手段の作動を停止させ、該リーク制御スイッチ手段を作動させて、当該電極の配線間の電位差を消滅させる工程、及び該セル部を所定の期間放電させるための期間において該第２の電源手段を作動させ交番電極に印加する工程とから構成される駆動方法である。

【００５５】又、本発明に係る該ディスプレイの駆動方法の他の態様としては、該表示データが書き込まれた該セル部を所定の期間放電させるための期間、即ち維持放電期間Ｓ－２中の該ドライバ回路４１０１の両端部の電位差を０に維持して表示処理を行う様にすることも出来る。更に、当該ドライバ回路４１０１の各スイッチ４０３及び４０４には、ダイオードＤ４０７とＤ４０８がそれぞれ並列に接続されており、当該維持放電期間Ｓ－２における維持放電電圧が、当該第２の電源手段４１０Ｂから、該ダイオードＤ４０７とＤ４０８を介してのみ表示パネルに印加せしめる様にしたものであっても良い。

【００５６】さらに、本実施例における駆動装置の駆動方法は、具体的には図５に示すようなスイッチ制御により、図５に示すような出力が得られる。図５に示すスイッチ制御において、スイッチ制御手段４０６、４５５はそれぞれ、コイル４０５、４５１を流れる電流を検知し、当該電流が０になる少し前のあたりで、スイッチ４１１、４１４をゆっくり閉じる制御を行い、０に達する時点では完全に導通状態する。

【００５７】スイッチ４１１、４１４を導通させはじめるタイミングは、実施例１、２で述べたと同様に、出力電圧が上昇時には最大レベルの１／２以上になった時点以降、または出力電圧が下降時には最小レベルの１／２以下になった時点以降とする。以上、本実施例によれば、電荷回収可能な回路において、フライバック電流が発生した場合にも、ＥＭＩ効果は減少させることができる。

【００５８】なお、本実施例における駆動回路はパネルと一体に構成され、パネル表示装置である図１０に示すようなプラズマディスプレイに利用できる。さらに、そのパネル表示装置は放送受信部を備えるテレビジョン装置に利用しても良い。テレビジョン装置に利用することにより、ノイズの発生が押さえられ、画面のちらつきなどを低減することができる。なお、図１１に放送受信部を備えたテレビジョン装置を示す。また、パネル表示装置はキーボードやマウスなどの入力操作装置とＣＰＵなどからなる演算処理装置を有するコンピュータ装置に利用しても良い。コンピュータ装置に当該プラズマディスプレイを用いることにより、ノイズを低減でき、誤動作が発生する可能性が少なくなるという効果が生ずる。コンピュータ装置の例を図１２に示す。

【００５９】（実施例４）次に、本発明の実施例４について図６および図７を参照して説明する。図６は、実施例４のプラズマディスプレイの駆動回路を示す。図６に示す駆動回路は、６０１は列電極を駆動する高耐電圧のＩＣ、６０２はデータ電圧Ｖｄの略１／２の、電荷回収用の直流電圧を印加する端子、６０３はデータ電圧Ｖｄの直流電圧端子、６０４はＩＣ（６０１）の接地端子、６０５、６０６、６０７はダイオード、６０８は電荷回収の対象となる列電極、および補助コンデンサの合成静電容量の略１００倍以上の静電容量を有する回収用コンデンサ、６０９は回収動率を小さくするための補助コンデンサ、６１０は電荷回収用のコイル、６１１、６１２、６１３はスイッチ手段、６１４はコイルに流れる電流を検知し、その電流の値によってスイッチ手段の開閉を制御するスイッチ制御手段、６１５はＩＣ（６０１）と駆動回路を接続する端子、６１６はデータ電極の一の端子である。

【００６０】図７に、本発明の第４の実施例に係る回路における電圧、電流波形等を示す。期間Ｔ１１においては、スイッチ手段６１１が導通し、補助コンデンサ６０９に蓄えられていた電荷をコイル６１０、ダイオード６０７、スイッチ手段６１１を通して、回収用コンデンサ６０８に回収する。期間Ｔ１１の終了時には端子６０３の電圧波形はゼロに近い最低値となる。なお、この期間（Ｔ１１）中、スイッチ手段６１２はオンでもオフでも構わない。これを図７（Ｄ）の破線で示す。

【００６１】期間Ｔ１２においては、ＩＣ（６０１）内の図示しないスイッチ手段のオン、オフ遷移を行う。この期間（Ｔ１２）中、スイッチ手段６１１はオンでもオフでも構わない。これを図７（Ｂ）の破線で示す。期間Ｔ１３においては、スイッチ手段６１２が導通し、ダイオード６０６、コイル６１０を通じて、補助コンデンサ６０９が充電される。また、これと並行して、スイッチ

手段６１２、ダイオード６０６、コイル６１０、ＩＣ（６０１）内のがデータの存在に対応してオン状態が選択されている図示しないスイッチ手段を通じて各列電極に電荷が充電されデータパルスが形成される。コイル６１０を通じて充電を行うので、回路内の電力損失はわずかである。端子６０３の電圧はデータ電圧Ｖｄ近くまで上昇する。

【００６２】このとき、スイッチ制御手段６１４がコイルを流れる電流が０になる時点の少し前を検知して、その少し前の時点でスイッチ手段６１３をゆっくり導通しはじめる。ここで、スイッチ６１３をゆっくり導通しはじめるタイミングは、出力電圧である端子６１６の電圧が最大値の１／２以上の時点以降である。なぜなら、端子６１６の電圧が最大値の１／２以下の時点では、電力効率が悪くなり、不具合により回路がショートする可能性が生ずるからである。

【００６３】期間Ｔ１４においては、既述のままスイッチ手段６１３はオンの状態である。また、端子６０３の電圧はデータ電圧Ｖｄでクランプされる。また、各列電極の電圧値はオン状態のスイッチ手段６１３およびデータの有無に従い、ＩＣ（６０１）内の図示しないスイッチ手段により電圧Ｖｄに、またＩＣ（６０１）内のスイッチ手段によりゼロ電圧に固定される。なお、この期間中、スイッチ手段６１２はオンでもオフでも構わない。これを図７（Ｄ）の破線で示す。

【００６４】以上のような動作によりデータパルスの電荷回収とデータの書き込みが行われる。また、スイッチ制御手段６１４によりコイルを流れる電流の減少を検知し、０になる時点の少し前の時点からスイッチ手段６１３をゆっくり導通しはじめるスイッチ制御を行うことにより、フライバック電流の発生を押さえられ、またフライバック電流が発生した場合にも、ＥＭＩ効果は減少させられる。すなわち、リンギング電流を除去できる。

【００６５】なお、本実施例における駆動回路はパネルと一体に構成され、パネル表示装置である図１０に示すようなプラズマディスプレイに利用できる。さらに、そのパネル表示装置は放送受信部を備えるテレビジョン装置に利用しても良い。テレビジョン装置に利用することにより、ノイズの発生が押さえられ、画面のちらつきなどを低減することができる。なお、図１１に放送受信部を備えたテレビジョン装置を示す。また、パネル表示装置はキーボードやマウスなどの入力操作装置とＣＰＵなどからなる演算処理装置を有するコンピュータ装置に利用しても良い。コンピュータ装置に当該プラズマディスプレイを用いることにより、ノイズを低減でき、誤動作が発生する可能性が少なくなるという効果が生ずる。コンピュータ装置の例を図１２に示す。

【００６６】（実施例５）次に、本発明の実施例５について図８および図９を参照して説明する。図８は、実施例５のプラズマディスプレイの駆動回路を示す。図８に示す駆動回路は、８０１は列電極を駆動する高耐電圧のＩＣ、８０２はデータ電圧Ｖｄの略１／２の電荷回収用の直流電圧を印加する端子、８０３はデータ電圧Ｖｄの直流電圧端子、８０４はＩＣ（８０１）の電荷回収用の端子、８０５はＩＣ（８０１）の接地端子、８０６はＩＣ（８０１）のデータ電圧Ｖｄを入力する端子、Ｄ８１～Ｄ８３はダイオード、８０７は電荷回収用の対象となる列電極、および補助コンデンサの合成静電容量の略１００倍以上の静電容量を有する電荷回収用コンデンサ、８０８は回収すべき列電極の静電容量の変動による回収静電容量の変動率を小さくするための補助コンデンサ、８０９は電荷回収用のコイル、８１０、８１１、８１２、８１３、８１４はスイッチ手段、８１５は各列電極に接続されるＩＣ（８０１）の出力端子の１つ、ＤＰ８１，ＤＮ８１はダイオードである。８１６はコイル８０９を流れる電流を検知して、当該電流が０になる時点の少し前あたりでスイッチ手段８１２をゆっくり導通する制御を行うスイッチ制御手段である。

【００６７】なお、８１５は多数存在する列電極の１つに接続される出力端子の１つを図示したものである。図９に、本発明の第５の実施例に係る回路における電圧波形等を示す。期間Ｔ９１においては、期間Ｔ９１以前にはデータパルスが印加されておらず、期間Ｔ９１以降に新たにデータパルスを印加すべき列電極に接続される端子８１５の電圧を図９（Ｆ）に示すように引き上げる。

【００６８】このために、スイッチ手段８１１を導通させ、回収コンデンサ８０７に蓄えられていた電荷をスイッチ手段８１１、ダイオードＤ８２、コイル８０９、スイッチ手段８１２、端子８１５を通して列電極に充電する。そして、当該列電極の充電が完了する、つまり、コイル８０９を流れる電流が０になる時点の少し手前で、スイッチ制御手段８１６がスイッチ手段８１４をゆっくり導通しはじめる。なお、スイッチ制御手段８１６はコイル８０９を流れる電流を検知し、当該電流が０になる時点の少し手前であることを判断して、スイッチ手段８１４を導通しはじめる。このスイッチ手段８１４を導通するタイミングは、上述と同様に、出力電圧、つまり端子８１５の電圧が最大レベルの１／２以降の時点である。実験によると、望ましくは出力電圧（端子８１５の電圧）の最大レベルの７５％ぐらいの時点が、エネルギー効率、ＥＭＩ防止の観点から都合が良い。

【００６９】期間Ｔ９２において、ＩＣ（８０１）内のスイッチ手段８１３をオフとし、ＩＣ（８０１）内のスイッチ手段８１４を引き続きオンとしているので、データパルス電圧をデータ電圧Ｖｄにクランプする。なお、スイッチ手段８１３と８１４は互いに相反する動作をするため、スイッチ手段８１３がオン（またはオフ）の場合はスイッチ手段８１４がオフ（またはオン）である。

【００７０】期間Ｔ９３においては、つぎのデータパルスが存在するため、端子８１５のパルス電圧は変更しな

い。このため、スイッチ手段８１２はオフ状態のまま、スイッチ手段８１４はオン状態のまま、スイッチ手段８１３はオフ状態のままとする。期間Ｔ９４においても端子８１５の電圧はデータ電圧Ｖｄのままであるから、スイッチ手段８１２、８１４、８１５の状態は変化させない。

【００７１】期間Ｔ９５においては、期間Ｔ９５以前にデータパルスが印加されており、期間Ｔ９５以降に新たにデータパルスを取り去る列電極につながる端子８１５の電圧を引き下げる（図９（Ｆ））。このために、スイッチ手段８１２を導通させ、列電極に蓄えられていた電荷を端子８１５、スイッチ手段８１２、コイル８０９、ダイオードＤ８３、スイッチ手段８１０を通して回収用コンデンサ８０７に回収する。

【００７２】そして、回収用コンデンサ８０７に回収し終わった時点、つまりコイル８０９を流れる電流が０になる時点の、少し前にスイッチ手段８１３をゆっくり導通しはじめる。なお、スイッチ制御手段８１６がコイル８０９を流れる電流が０になる時点の少し前であることを検知して、上記のようなスイッチ手段８１３の制御をする。

【００７３】このように、本実施例ではデータパルスの省力効果を著しく高めることができ、かつ高速動作を実現できるデータパルス駆動回路において、フライバック電流の発生を押さえられ、またフライバック電流が発生した場合にも、ＥＭＩ効果は減少させられる。すなわち、リンギング電流を除去できる。なお、本実施例における駆動回路はパネルと一体に構成され、パネル表示装置である図１０に示すようなプラズマディスプレイに利用できる。さらに、そのパネル表示装置は放送受信部を備えるテレビジョン装置に利用しても良い。テレビジョン装置に利用することにより、ノイズの発生が押さえられ、画面のちらつきなどを低減することができる。なお、図１１に放送受信部を備えたテレビジョン装置を示す。また、パネル表示装置はキーボードやマウスなどの入力操作装置とＣＰＵなどからなる演算処理装置を有するコンピュータ装置に利用しても良い。コンピュータ装置に当該プラズマディスプレイを用いることにより、ノイズを低減でき、誤動作が発生する可能性が少なくなるという効果が生ずる。コンピュータ装置の例を図１２に示す。

【００７４】

【発明の効果】以上説明したように、本発明におけるプラズマディスプレイ駆動回路によれば、エネルギー回収のためにインダクタを流れる電流が０になる少し手前で電圧クランプ用のスイッチを制御しはじめるために、ＥＭＩ効果は減少させられる。また、リンギング電流を除去することができる。すなわち、正確に制御できるエネルギー回収を可能にしそして誘導的に発生したフライバック電流がパネルの画素位置に不利に影響を及ぼすことを防止することができる。

【図面の簡単な説明】

【図１】本発明の実施例１におけるＸドライバおよびＹドライバの要部回路構成図

【図２】本発明の実施例１におけるプラズマディスプレイパネルの駆動方法の１例を示す電圧波形図

【図３】本発明の実施例２におけるプラズマディスプレイ駆動回路図

【図４】本発明の実施例３におけるプラズマディスプレイ駆動回路図

【図５】本発明の実施例３におけるプラズマディスプレイパネルの駆動方法の１例を示す電圧波形図

【図６】本発明の実施例４におけるプラズマディスプレイ駆動回路図

【図７】本発明の実施例４におけるプラズマディスプレイパネルの駆動方法の１例を示す電圧波形図

【図８】本発明の実施例５におけるプラズマディスプレイ駆動回路図

【図９】本発明の実施例５におけるプラズマディスプレイパネルの駆動方法の１例を示す電圧波形図

【図１０】プラズマディスプレイの例を示す図

【図１１】テレビジョン装置の例を示す図

【図１２】コンピュータ装置の例を示す図

【図１３】プラズマディスプレイ駆動回路図

【符号の説明】

Ｙ１～Ｙｎ、４０２　走査電極

Ｘ、４０１　維持電極

１１　Ｘドライバ

１２　Ｙドライバ

１１１、１２２、３１０１、６０８、６１０、８０７　回収用コンデンサ

１１５、１１２Ａ、１１２Ｂ、１１４Ａ、１１４Ｂ、１２３Ａ、１２３Ｂ、１２５Ａ，１２５Ｂ、３４１Ａ～３４ｎＡ、３４１Ｂ～３４ｎＢ、３１０２、３１０３、３１０７、３１０８、３２０２、３２０３、４０４、４１３、４１４、４１７、４１８、６１１、６１２、６１３、８１０、８１１、８１２、８１３、８１４　スイッチ手段

１１３、１２４Ａ、１２４Ｂ、３１０４、４０５、４５１、８０９　コイル１２１　半導体集積回路

１２６Ａ，１２６Ｂ、３１０９、４０６、４５５、６１４、８１６　スイッチ制御手段

３１　無効電力回収回路

３２　ドライバーＩＣの出力回路

３１０５　高電位側電源

３１０６、３１１０　低電位側電源

３１１１　無効電力回収回路の出力

３２０１、８０６　入力端子

３２０４　高電位側電源端子

３２０５　低電位側電源端子

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３２　ドライバーＩＣの出力回路
３３、８１５　出力端子
３４　負荷容量
４１０１　ドライバ回路
４１０　電源回路手段
４１０Ａ、４１０Ｂ　電源手段
４１２、４１３、４１５、４１６　電圧発生手段
４１１　電源発生手段
４２０　リークスイッチ手段
４５０　電力回収回路

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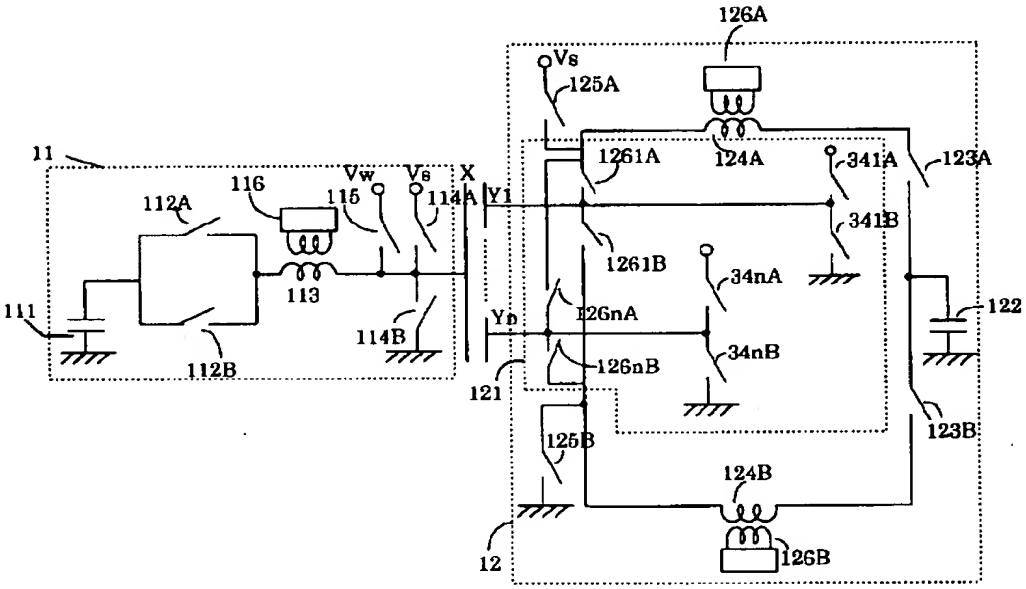
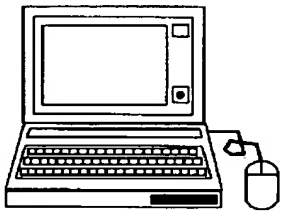
４５４　コンデンサ
６０１、８０１　高耐電圧ＩＣ
６０２、８０２　電荷回収用の直流電圧を印加する端子
６０３、８０３　直流電圧端子
６０４、８０５　ＩＣの接地端子
６０９、８０８　補助コンデンサ
６１５　ＩＣと駆動回路を接続する端子
６１６　データ電極の端子
８０４　ＩＣの電荷回収用の端子

10

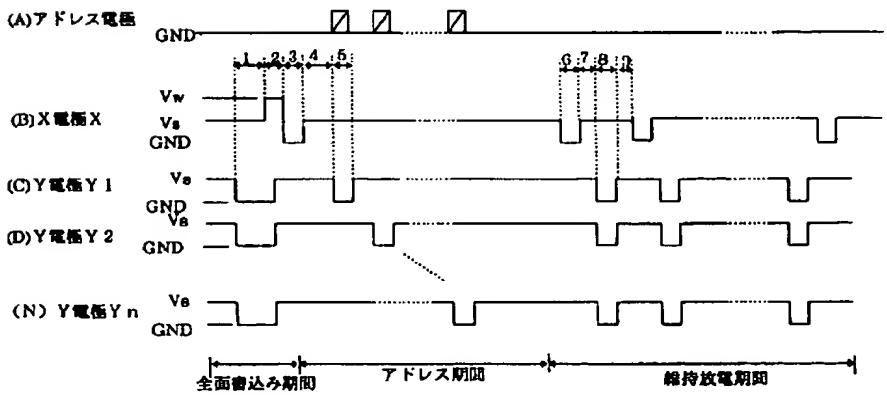
【図１】



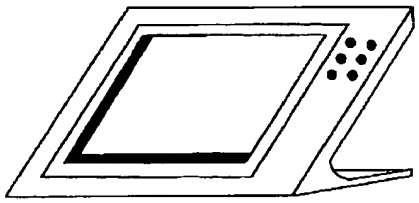
【図１２】



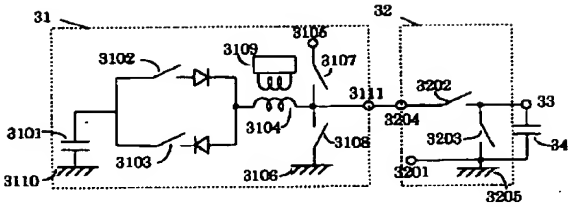
【図２】



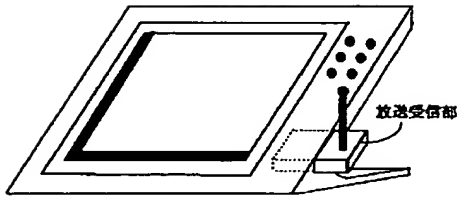
【図１０】



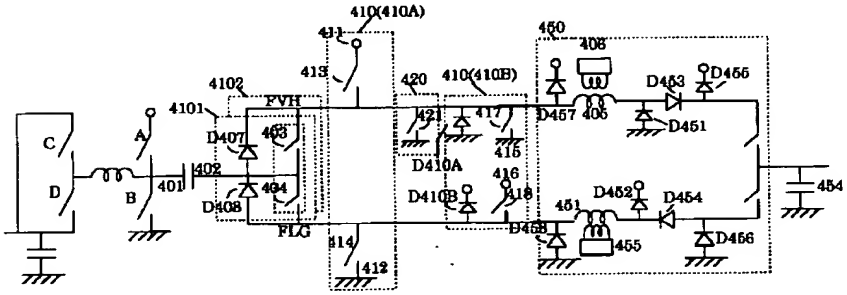
【図３】



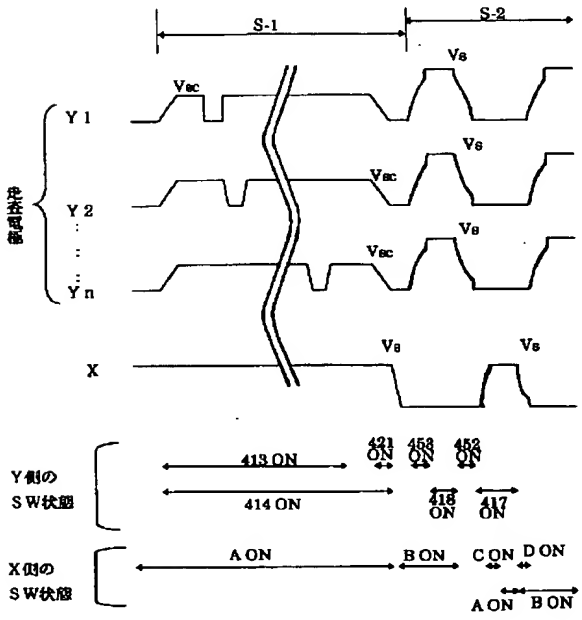
【図１１】



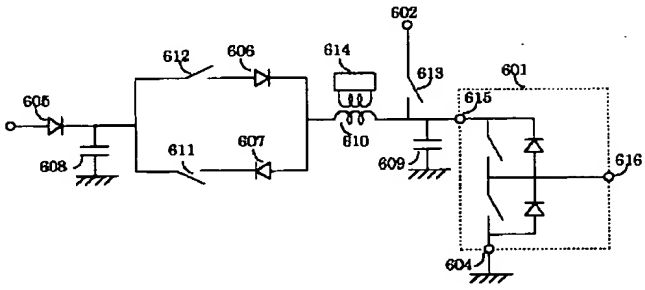
【図４】



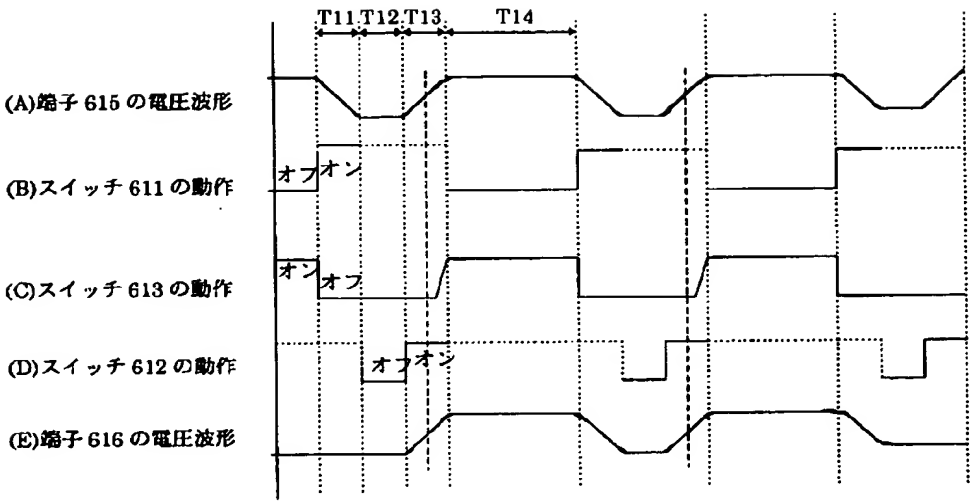
【図５】



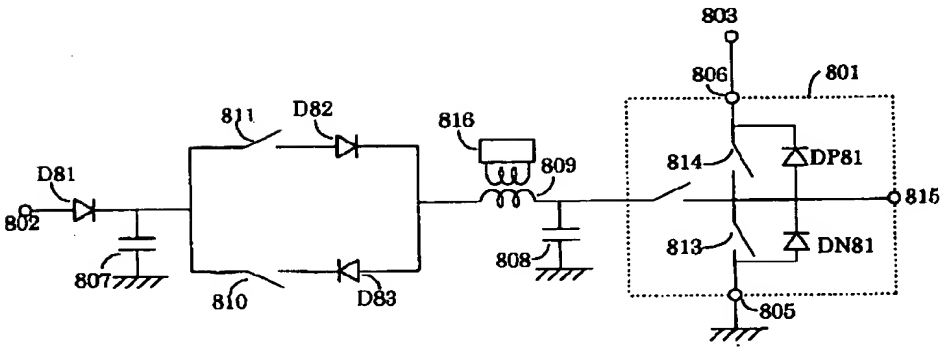
【図６】



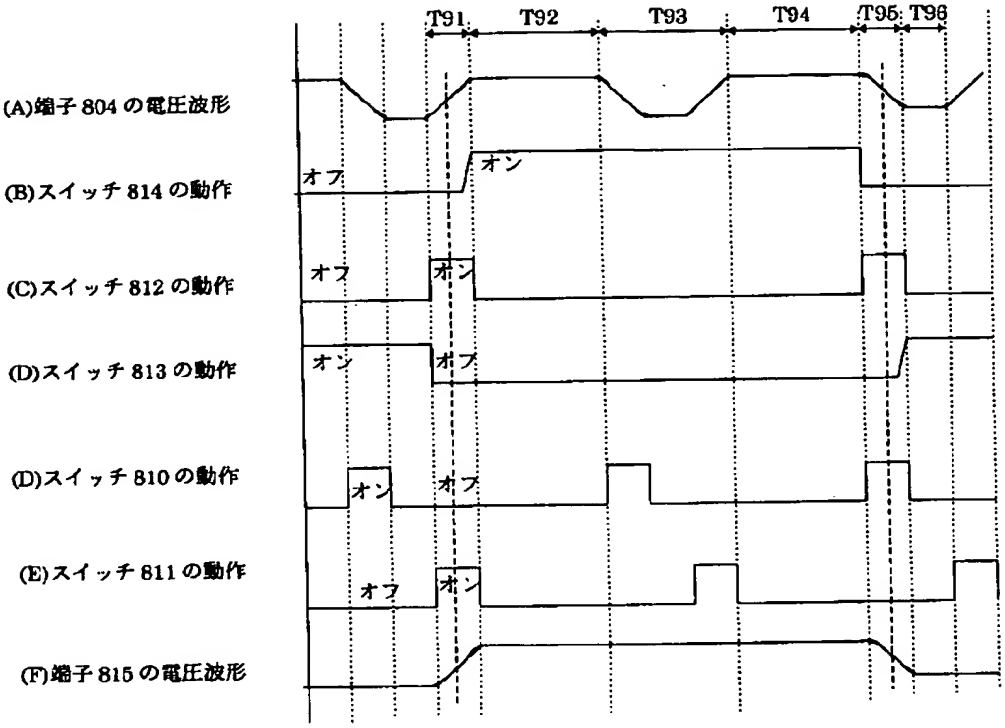
【図７】


T11
T12
T13
T14
(A)端子 615 の電圧波形
(B)スイッチ 611 の動作
オフ
オン
(C)スイッチ 613 の動作
オン
オフ
(D)スイッチ 612 の動作
オフ
オン
(E)端子 616 の電圧波形

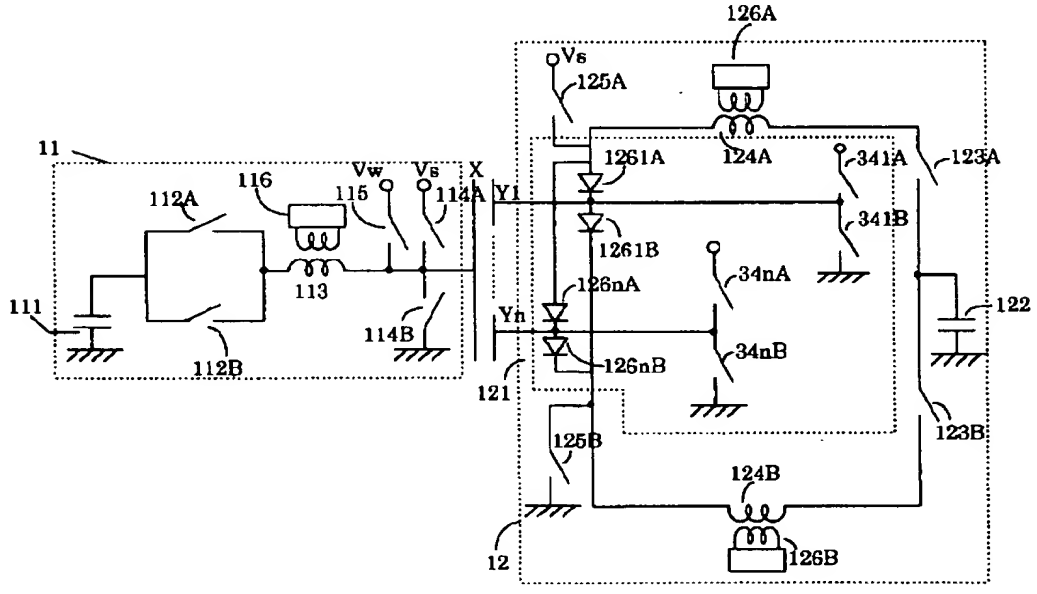
【図８】


803
806
801
811
D82
816
809
814
DP81
815
D81
802
813
DN81
807
808
810
D83
805

【図９】


T91
T92
T93
T94
T95
T96
(A)端子 804 の電圧波形
(B)スイッチ 814 の動作
(C)スイッチ 812 の動作
(D)スイッチ 813 の動作
(D)スイッチ 810 の動作
(E)スイッチ 811 の動作
(F)端子 815 の電圧波形
オフ
オン
オフ
オン
オン
オフ
オン
オフ
オフ
オン

【図１３】


11
111
112A
112B
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114A
114B
115
116
Vw
Vs
X
Y1
Yn
121
12
122
123A
123B
124A
124B
125A
125B
126A
126B
126nA
126nB
1261A
1261B
341A
341B
34nA
34nB